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The Merger of "Municipal News" and "Water Works"

With this issue the oldest municipal magazine merges with the oldest water works magazine in America. "Municipal News" was founded in 1890 as "Municipal Engineering." "Water Works" was founded eleven years ago as an hydraulic monthly issue of the weekly magazine, "Engineering and Contracting." Later "Water Works" was entirely separated from the parent magazine.

"Municipal News and Water Works," the new name of the merged magazines, starts its career with a net paid circulation that exceeds 11,700. The gross circulation is 16,000.

This magazine will be edited by Halbert P. Gillette, chief editor; C. T. Murray, managing editor, and Charles Carroll Brown, associate editor. Mr. Brown was for many years the editor of "Municipal Engineering," and his old readers will be glad to hear that he has taken up his editorial pen again.

The editorial policy will be to publish both technical and non-technical articles relating to the design, construction, maintenance and operation of city "works." We use the term "works" to designate what private companies usually call "plant," sewers, waterworks, pavements, traffic signals, swimming pools, playgrounds, schools, street lights—all the structures, machines and devices that comprise the "plant" with which a modern municipality serves the public, constitute the municipal "works" with which this magazine deals.

There is but one other American municipal magazine of national circulation that attempts to cover this broad field. A comparison of the articles in our issues with those in any issue of our contemporary will show that there is very little duplication either as to the particular subjects or as to their editorial treatment. In fact it is impracticable for a single monthly magazine to cover this field completely.

There are five large and thriving monthly architectural magazines of national circulation, not to mention several others edited primarily for builders rather than for architects. There are four large civil engineering and contracting magazines of national circulation, besides several devoted to various branches of that field. Such facts make it clear that at least two large national magazines are needed to serve the municipal field.

"Municipal News" has been owned by the Gillette Publishing Co. for 12 months. A careful study of its paid circulation and that of "Water Works" has shown the publishers that three-fourths of the subscribers of the one are either actual or potential subscribers of the other. This springs from the fact that the average city engineer, city official, and city superintendent has several functions to perform, and therefore needs more than a narrowly specialized magazine.

Of the 10,000 American municipalities only a few hundred are large enough to warrant the employment of different men to perform each of the different functions involved in designing, building and maintaining the city "works."

With this brief outline of our editorial and publishing policies we greet our old readers of both magazines, and submit the first issue of the enlarged magazine.

Some Suggestions for Electric Signals at Crossings

An insurance adjuster recently told the editor that 85 per cent of the motor car accidents that he handles are collisions at highway crossings. Where automatic signals have been placed at crossings, accidents are rare. Does this not point the way very clearly to one of the means by which such accidents may be almost eliminated? Shall we not ultimately come to electric "stop and go signals" at almost every street intersection? Shall we not find the same protection desirable at all road crossings where any obstruction prevents a clear view of vehicles approaching along both roads? The expense of any such general system of signalling will be enormous, but we believe it may be found to be justifiable. At any rate, the steadily mounting record of casualties calls for something more effective than fines or even imprisonments.

If highway crossings need electric signals, certainly railway crossings need such signals even more. Here the state should share the expense with the railway. In addition to signals at railway crossings it may become desirable to install some sort of device that will act

somewhat as do the "telltales" in front of a railway tunnel. These "telltales" are merely short pieces of rope suspended from a wire across the track, a short distance from the tunnel. A careless brakeman walking on top of a freight car feels the impact of the "telltales," and hastens to crouch. In like manner, a wire-cage drum might span a road, and the "telltales" might be wound around the drum. On the approach of a train, the drum would be tripped, and the "telltales" would drop so as to form a sort of rope curtain across the road, which no automobilist would be likely to pass. The "telltales" would be wound up automatically as soon as the train had passed.

Laws that attempt to govern the speed of automobiles have not accomplished the result, primarily because it is impracticable to patrol the highways with enough policemen. But this does not necessarily mean that we must forever depend upon the common sense and integrity of car drivers to drive at safe speeds. It would be feasible to install automatic drop "telltales" along highways at intervals, which would so operate that any car exceeding the prescribed limit would find its windshield repeatedly battered by the suspended ropes. Already "stop and go signals" are operated in many cities by "the progressive system," in such a manner that a car may proceed in one direction at a prescribed speed without interruption. A lower or higher speed causes interruption of the car's progress. Thus the speed of the traffic is controlled automatically. Some such control may ultimately be adopted even for country roads. But while signal lights serve well in a city where policemen are at hand to enforce respect for them, something else may be needed on country roads, such, for example, as the suggested drop "telltales."

The problem of traffic control in cities has already been largely solved by automatic signalling, supplemented by the "traffic cop." It remains only to perfect some of its details, and to make it practically universal. The problem of traffic control on country roads is more difficult, and has scarcely yet been given serious engineering study.

The Distinction Between City Progress and City Wastefulness

The rising cost of city government is a frequent cause of criticism. Yet criticism merely because such costs have risen is no more justifiable that diatribes against the high cost of living. There are some writers who think they have damned a city administration when they have shown that its annual budget has doubled in the last 15 years. They conveniently overlook the fact that, due to the inflation of our currency, wages and salaries have more than doubled. They often forget to mention that the city has grown 30 or more per cent in population. And they rarely consider the fact that per capita production in America is fully one-third more than it was 15 years ago.

When people produce more they must of necessity consume more, else their increased productivity is senseless. If they choose to employ a large part of their increased productive power in the building of better streets, better hydraulic works and more commodious public buildings and schools, they are not the extravagant fools that their critics would have us believe.

While the nature of municipal construction and maintenance has not changed greatly during the past decade, its volume has increased greatly and seems likely to go on increasing in geometrical ratio. Perhaps the newest branch of municipal construction relates to traffic control by signalling apparatus, if we except the building of aviation fields. The motor car has created the one; the airplane is creating the other.

Municipally owned golf-links, tennis courts, bowling greens, swimming pools, and other municipally owned "entertainment plants," as they may be called, are becoming rapidly more numerous. An age of diffused wealth is ushering in an age of entertainment and sports. Man's "work from sun to sun" began to vanish about a century ago. The 44-hour week is now quite common, and the 40-hour week is in the offing. All this has come because brains and freedom to use the results of brain work have quintupled the annual output of the average American worker during the past century.

When we read protests about municipal extravagance, we may be quite sure that they come from men who have not studied the statistics of American productivity. Our great-great grandfathers had all the necessities of life, for they lived. We who have five-fold their real income must spend at least four-fifths of it for "luxuries"; and we do. Yet many of these so-called "luxuries" actually create more knowledge, by the aid of which our productivity is increased.

The motor car was at first a luxury affordable only by the rich. It is now not only the every day tool of millions, but its development has affected numberless economies. Our transportation costs have been greatly reduced by the motor car. As against the Chinese coolie still pushing his ancient one-wheel barrow, or the Japanese jinrikisha man trundling his two-wheel buggy, contrast our motor trucks and automobiles. No Chinese editors are urging taxpayers to vote against the "extravagance" of paving streets, or building schools. Poor devils, they have no money to be extravagant with. Necessity has squeezed their income lemon so dry that no juice for "extravagance" remains.

In a celebrated French treatise on "The Theory of Probabilities," its author, M. A. Quetelet, says: "It has been justly remarked that those are the most civilized countries that pay proportionately the most to the government." Of course there are exceptions to this generalization, as when a socialistic government or a government burdened by a huge war debt extracts from its citizens much more than 10 per cent of their gross income. But it is certainly true that as a rule, only wealthy peoples devote a considerable part of their income to the building, operation and maintenance of public works. And, with rare exceptions, the more intelligent peoples are the wealthier. Peculiar indeed would be our intelligence were we to attempt to hold down our municipal expenditures to the level of 15 years ago, when our real income per capita has increased fully one-third.

H. P. Gillette

Water Sampling Devices for the Water Works Operator

Aids in Controlling the Purification Processes

By J. D. EDAL BEHRAM
Shanghai Water Works Co., Ltd., Shanghai, China

IN a water plant convenient water sampling devices are a great help in controlling the purification processes.

Figure 1 shows a sampling stick (any convenient length) of the pull-push type capable of carrying two bottles one 250 c. c. and the other 500 c. c. size. The sampling stick is immersed to any desired depth (judged by a scale marked on the stick for the purpose) in the water, the brass rod pulled (which withdraws the stopper) and pushed down as soon as the bottle is full. This device is very convenient for open water volumes and shallow depths.

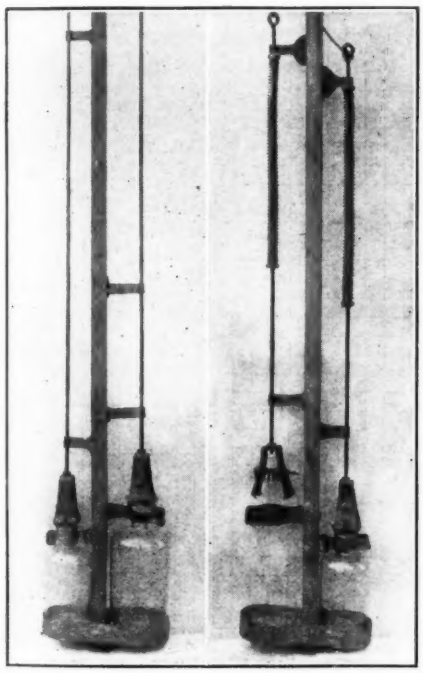


Fig. 1

Fig. 2

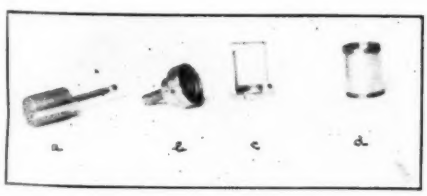


Fig. 3

Figure 2 shows another device for sampling filter wells, reservoirs and the like. Here the brass rods are eliminated and a string used instead for withdrawing and replacing stoppers. The string is just pulled and let go when the bottle is full the spring on the top of the clamp putting the stopper in place. The stick can be made as long as desired by joining together convenient wooden lengths by means of bolts and adding the corresponding length of string.

Figure 3 shows the component parts of an average sampler. When an average sample is desired from several places, say several filter beds, the sampler is sterilized in the usual way and attached to the mouth of a sterilized bottle with a sterile rubber cork (see Fig. 4). The sampling arrangement is immersed in the volume of water to be sampled, the string is pulled and after a few seconds let go. This injects into the bottle a measured quantity of water each time that the bottle is introduced into a new source and the string pulled and released.

With a 10 c. c. capacity sampler as many as 20 samples can be conveniently taken with an ordinary 250 c. c. bottle without any risk of contamination. This obviates the necessity of sterilizing large quantities of bottles, pipettes, etc., when testing the efficiency of several groups of filter beds and comparing the filtering efficiency of individual filter groups of say 5-20 beds in a purification plant. Where the plant is very large and filtering units, clear water wells, etc., numerous this sampler should prove of great use.

Figure 3 (a) shows the plunger with a guide rod and spring, and a strip bent at right angles to the plunger. (b) is the base with nozzle cap. A straight hole through the base connects the barrel (d) with the interior of the bottle. Two holes, one bored on the side and another bored half way up through the base (see Fig. 5) to meet at right angles to the one bored on the side, form an elbow passage for

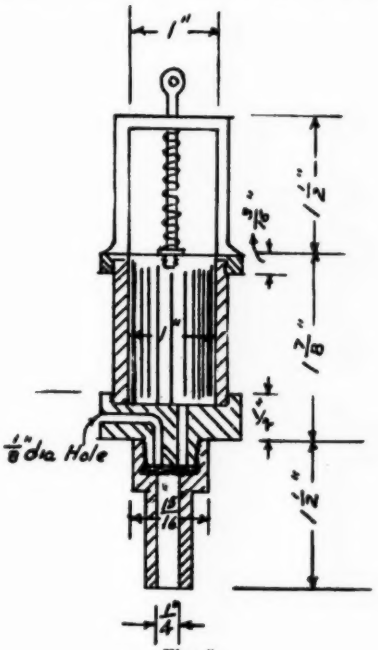


Fig. 5

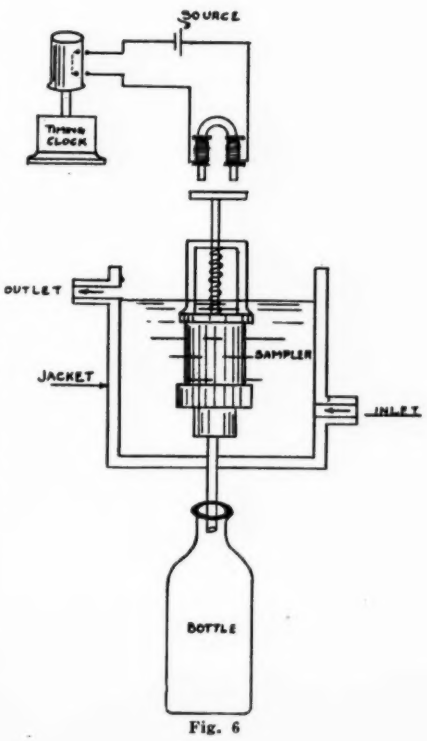


Fig. 6

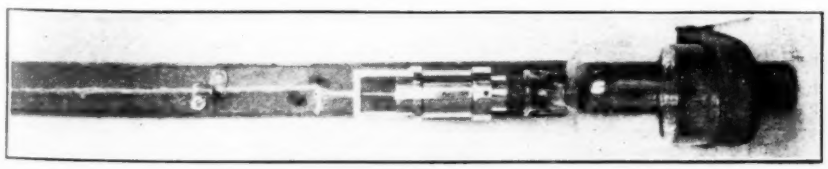


Fig. 4

the in going water and out coming air. (c) serves as a cap with stirrup guide. The spring strip bent over at right angles and attached to the plunger runs parallel to the barrel and meets the orifice of the water inlet and air release passage (just described) in the base. This strip is indented at its lowest point to form on its inner face a small projection which snugly fits into the orifice at the base. This arrangement acts as a combined air release and stop valve.

When samples are to be taken continuously and at regular intervals so as to obtain a good daily average sample, the arrangement shown in Fig. 6 should prove useful. In water plants drawing water from tidal rivers a good average daily sample for the purpose of determining the optical turbidity, suspended matter, chlorine, alkalinity, etc., is an absolute necessity. Samples taken at random or without proper intervals are not much good. The timing clock actuates an electromagnet (which admits water into the sampler at proper intervals and injects it into the bottle) by a revolving make-and-break contact piece making say one revolution per hour if an hourly sample is desired. The water to be sampled continuously runs in and out to waste from the encircling jacket which may be connected to the pump.

Gaining Additional Capacity in Standpipe

Inadequate Structure Rebuilt As Water Tank

By S. S. GEAR
Contracting Engineer, Horton Steel Works, Bridgeburg, Ont.

IN order to increase the volume of water available in overhead storage, the Township of Stamford, surrounding the City of Niagara Falls, Ontario, is undertaking an unusual job of rebuilding an existing standpipe. This township is one of the richest in that portion of Ontario, most of the transmission lines of the power companies passing through the territory. The population is greatly scattered, thus necessitating long water services for supplying residences in the outlying districts from the heart of the business center.

The existing standpipe, grown unable to satisfy the requirements of the water system, was one built some time ago. This standpipe was 14 ft. 4 in. in diameter and had a height of 100 ft., therefore possessing a volume of approximately 126,000 gal. (U. S.). The demand for water in the summer months had become so great that the supply finally proved inadequate, and in fact the homes in the vicinity of the standpipe could not obtain water on the second floors, as a maximum head of water could not be maintained in the standpipe, and the head actually available was not usually sufficient to deliver the required pressures at the second floor fixtures in these homes.

In order to maintain the original maximum head theoretically supplied by this standpipe, a greater storage volume had to be made available.

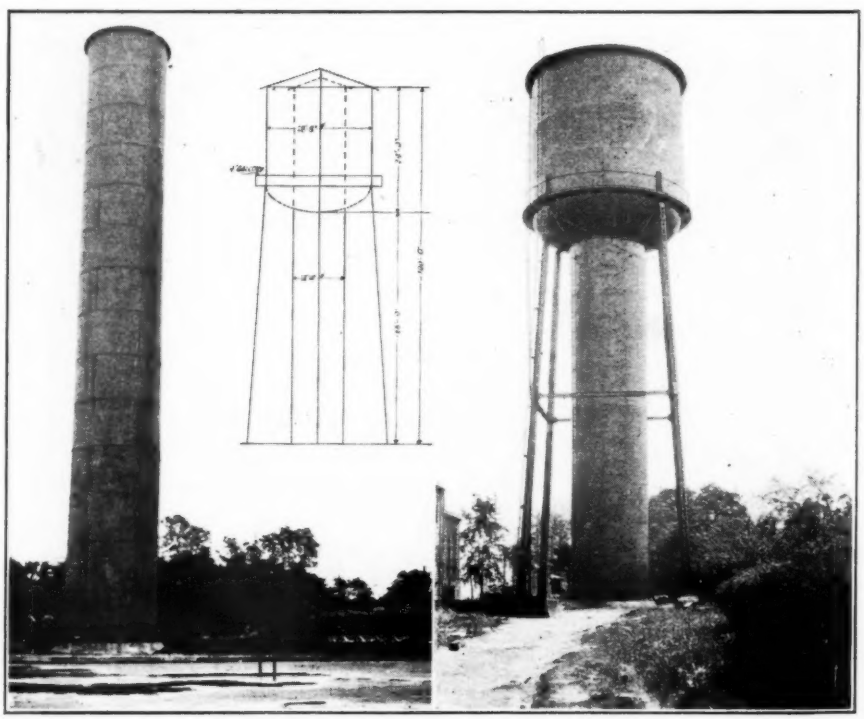
To do this it was decided to remove 34 ft. from the top of this existing standpipe and replace this removed section with a 28 ft. 8 in. diameter elliptical bottom conical roof tank, the top of which, after connection would be made with the remaining portion of the standpipe, would be 100 ft. above the top of the foundations. The elliptical bottom of this tank would, under this plan, be framed into the original standpipe at the top of the remaining portion, approximately 66 ft. above the foundations.

The work was done in this manner, as shown in the drawing, with the dotted lines showing the original standpipe and the heavy lines showing the completed work.

In constructing the work in this way, the remaining portion of the old standpipe serves as a riser pipe to the elevated elliptical bottom tank, and the bottom of this 14 ft. section also acts as a good sediment basin since the inlet pipe in the bottom extends some 8 or 10 ft. up into the standpipe.

This construction, of course, does not increase the available head, since the top remains at 100 ft. above the foundations as before, but the increased diameter affords a volume of 156,000 gal. (U. S.) stored in this tank the bottom of which is 66 ft. above the foundations. This affords a more ample supply for peak demands and thus will more nearly maintain the desired maximum head than was possible before. The result is better service to the consumer.

This work was done by the Horton Steel Works, Ltd., of Bridgeburg, Ont., a subsidiary of the Chicago Bridge and Iron Works, Chicago, Ill., from a design prepared by the writer.



This Drawing Shows the Existing Standpipe, Dotted Lines, and the Modified Structure, as Built. Using the Lower Two-Thirds of the Existing Standpipe in the New Structure Views Showing the Old and New Structures

Automatic Electrical Equipment in Sewage Disposal Plants

A paper on "High tension and automatic electric equipment at the 26th Ward sewage disposal plant, Brooklyn," presented last winter before The Municipal Engineers of the City of New York, Victor Greiff, Electrical Engineer, Bureau of Sewers, Borough President Office, Brooklyn, N. Y., gave the following conclusions:

"In general, it may be said that electrical equipment, of whatever complexity required, for automatic service of every kind, without limit of voltage, can be used successfully in the sewage disposal plant, by

(a) Proper selection of types of standard apparatus,

(b) Protecting certain parts of it in a separate, clean, dry compartment, and

(c) Enclosing other parts in rugged cases."

Special Assessment Procedure for the Construction of Municipal Improvements

Summary of Practice in 24 American Cities

By WALTER MATSCHECK
Director of the Kansas City Public Service Institute

SPECIAL assessments are an important source of funds for the construction of municipal improvements. their amount in some cities exceeds the amount of taxes collected to pay bonds. There are limits on taxes and limits on indebtedness; but fewer limits on the amount of special assessments except for the theoretical one that they cannot exceed the benefits on any certain piece of property. Actually property is sometimes abandoned because of exorbitant special assessments.

In spite of the importance of this source of revenue, very little attention has been paid to the problem. There is little uniformity, and practically no standard of procedure. Many Kansas City property owners felt that they paid higher special assessments than do those in other cities. The present study was made to get the facts in the matter. Questionnaires were sent to all of the larger cities in the country and to a few smaller ones near Kansas City. Twenty-three replies were received. The facts contained in this report are based upon information from the following cities: Philadelphia, Detroit, Cleveland, St. Louis, Baltimore, Los Angeles, Pittsburgh, San Francisco, Buffalo, Milwaukee, Newark, Minneapolis, New Orleans, Kansas City, Seattle, Indianapolis, Rochester, Toledo, Portland, Denver, St. Paul, Omaha, Des Moines, and Duluth.

Theory and Practice of Special Assessments

Types. — Special assessments are levied only when there is a special benefit to the property. This report deals with two types of special assessments.

(a) Assessments on properties within a district created for the purpose to pay part or all of the cost of specified improvements constructed or services rendered within that district. Street improvements are an example. The cost is assessed against the properties in various ways—front footage, area, or valuation.

(b) Assessments on properties benefited by public improvements or services in proportion to, and not in excess of the amount of such benefit. Park purchases are an example in Kansas City. The benefits and assessments are generally determined by a commission or a jury.

Cost vs. Benefit.—Two distinct types of special assessments have come to be confused under the common term of benefit assessments. In the true benefit assessments, an honest attempt is made to measure the probable enhancement in land value which may reasonably be expected as a result of the improvement, and to apportion the costs on the properties affected in proportion to, but not in excess of, these anticipated enhancements. In the other type —which for brevity will hereafter be referred to as a cost assessment—the apportionment of cost is based directly on some physical characteristic of the property which affects cost; such as frontage, for example, in the case of street paving and sidewalks, and area in the case of storm sewers or combined storm and sanitary sewers. Under certain circumstances, the spreads made by the latter method for minor improvements, will conform with reasonable accuracy to a true benefit assessment. In the case of all improvements, however, which benefit an extensive area, as well as in many purely local improvements in sections when the lot lay out is irregular, or the topography uneven, the spread of costs on the basis of physical functions of costs, is not in harmony with benefits.

The legal limitations found in all cities may be fixed by the state constitution, by state law, or by city charter. They regulate improvements and services which may be paid for by special assessments, the method of fixing the assessment, the amount of assessment, the type of property subject to assessment, etc.

There are two methods for the payment of the contractor:

(a) In cash, partly from property owners who pay the assessment in full before or just after the completion of the work, and partly from the sale of special assessment bonds. These bonds are liens against the property and may or may not be guaranteed by the city.

(b) By certificates of assessment. In this case the contractor is responsible for collections and suffers the loss of those that are uncollectible.

Special Assessments in Kansas City. —Under the power of the Kansas City charter special assessments are regularly levied for certain purposes.

Operation and Maintenance of Parks and Boulevards.—This assessment is made by districts at $2.50 per $1,000 assessed valuation of land. In addition, for boulevard maintenance there is an annual assessment of ten cents per front foot of all property fronting on boulevards. These assessments, with the money from automobile licenses, furnish most of the funds for the operation and maintenance of parks and boulevards.

Prior to the adoption of the city gasoline tax in 1923, street repairs were assessed against abutting property on a front-foot basis. Street oiling may be assessed, but never has been assessed in practice.

Improvements.—The following are most frequently paid for by special assessments:

1. Paving.
2. Repaving.
3. Curbing and guttering.
4. Sidewalks.
5. Grading.
6. Street openings.
7. Street widening (with city aid at times).
8. Sanitary sewers (with certain exceptions).
9. Storm sewers (with certain exceptions).
10. Parks.
11. Playgrounds.

Assessments for all improvements, except those involving condemnation, damage or purchase of property, are charged to benefited property by the cost type of assessment. The cost of property damaged, purchased or condemned is assessed against a benefit district according to the benefit type of assessment.

Improvements assessed by the front foot rule include paving and repaving, sidewalks, curbing and guttering. The entire cost is paid including intersections. Corner lots pay full assessment on both fronts. The method of assessing paving and repaving is objected to chiefly because (1) the full cost of repaving arterial highways is assessed, and (2) because corner lots pay a disproportionate part of the cost. There has been some feeling that part of the original paving of arterial highways should be met by the city at large.

Grading is assessed according to assessed valuation of land deemed benefited. Small grading projects are charged against adjoining property to a line half way to the next street. More expensive jobs are paid for by larger districts divided into not more than

three zones and assessed according to; first zone 100 per cent, second zone 50 per cent, and third zone 25 per cent of assessed valuation.

In street opening and widening the cost of property taken or damaged is assessed against property in a certain district fixed by the council. Assessment of benefits is made by a condemnation jury appointed by a judge of the municipal or circuit court. On larger projects, part of the cost may be assessed against the city with the city's consent.

With the exception of three large sewers built recently from bond funds, all sewers of all kinds in Kansas City have been paid for by special assessments. The assessment is spread on an area basis by districts. These districts include the area drained. There is no limitation on the size of the sewer that may be assessed or on the amount of assessment. Sanitary and storm sewers are treated alike. There has been little objection to assessing sanitary sewers in this manner; but such assessment of storm sewers has worked a hardship on high-lying property especially when it is low in value.

The acquisition of property for parks and playgrounds is generally paid by a benefit district, the boundaries being determined by the council and the assessment, by a jury.

Tax Bills and Local Improvement Certificates.—Two types of special assessment securities are used in Kansas City—tax bills and local improvement certificates.

Tax bills are used for all improvements except when property is taken or damaged. The contract always specifies that payment is to be made in tax bills and, after the work is completed and the assessments computed, a tax bill is issued, against each property assessed, in favor of the contractor. The contractor then receives these tax bills and the city's responsibility ends. They may be assigned and are collectible by suit. The amount becomes a lien upon the property. The city treasurer keeps a record of the tax bills issued and includes the amount on the bill for general taxes. Payment may be made to him. This is merely a convenience to the property owner.

The second form of special assessment securities is local improvement certificates and they are issued when property is taken. They resemble special assessment bonds of other cities but are not guaranteed by the city. They bear 6 per cent interest and may not be sold at less than par. The city collects the assessments and distributes the collection pro-rata semi-annually to certificate holders. The city may make up any deficiency from the general fund and in practice usually does so. Due to uncertainty as to the time and amount of payment these certificates cannot compare with city bonds as an investment. An attempt was made in the city charter adopted in 1925 to provide cash payment to contractors and to permit the city to pay deficiencies. A revolving fund was set-up for this purpose. Little has been done, however, toward working out the plan.

The Amount of Special Assessments.—An average of about $2,600,000 has been levied in special assessments in Kansas City during the last ten years. In comparison with other cities Kansas City may be considered neither high nor especially low. Ten of the twenty-four cities considered in this report have higher amounts per capita and ten have higher amounts per $1,000 valuation.

Summary of Special Assessment Practice in 24 Cities

(Information obtained from questionnaires)

Paving.—The method most often used in assessing paving costs is the assessment of abutting property by the front-foot method. It is used completely, however, in only four cities. In several others intersections are paid by the city and the remainder by the abutting property. In ten of these cities paving costs including intersections, are assessed. In six all of the paving except intersections is assessed and in the remaining eight, other methods are used. In Cleveland and Toledo the city pays intersections plus 2 per cent of the remaining cost. In Pittsburgh and Milwaukee the assessment is to the extent of actual benefit and the remainder is paid by the city. In St. Paul the abutting property is assessed for a 12-ft. strip, the balance and intersections being paid by the city. In Newark the assessment varies according to the character of the street, the city paying as high as 80 per cent of the cost. In Philadelphia paving on parkways, boulevards and special traffic streets is paid entirely by the city and on other streets the city pays for intersections and for the work in front of tax-exempt property. In Baltimore part is paid by a special paving tax, part by special assessment, and the remainder by the city.

Sixteen of the 24 cities assess benefits on the front-foot basis, one on the area basis, and four use zones or depth curves. In St. Louis one-fourth is assessed against abutting property on a front-foot basis and three-fourths against a benefit district on an area basis. Pittsburgh and Milwaukee assess on a strictly benefit basis.

In 15 cities only abutting property is assessed. In three cities property half way to the next street is assessed, and in two, property 150 ft. from the paving. In San Francisco and New Orleans all except intersections are paid for by abutting property, intersections being assessed on the frontage of intersecting streets to a distance of one-half block from the intersections. In Duluth for the cost of the paving on the short side of the block, the assessment is spread to the center of the block.

Repaving.—Five cities make no assessment for repaving. In these cases it is paid either from the general city fund or from bond funds. Fifteen cities assess in the same manner as for original paving; but in three of these there is a very slight modification; in St. Louis, if a street is to be repaved within ten years, at least one-fourth of the cost must be paid by the city; in Milwaukee repaving assessments are limited to $3.00 per sq. yd.; and in St. Paul no repaving assessments may be made within 15 years. In Cleveland the city must pay the cost of intersections, plus 2 per cent of the cost of the remainder, plus an amount equal to one-half of the highest previous assessment for paving against that property. In Buffalo two-thirds of the cost may be assessed against benefited property; in Indianapolis, one-fourth may be assessed; and in Toledo, one-half is assessed. There is a tendency in both paving and repaving to modify the rigid plan by lessening the amount of assessment for paving, and dividing repaving between the city and the benefited property.

Curbing and Guttering.—The method of paying for curbing and guttering follows the procedure for paving assessments or is included in the cost of paving, in 20 of the 24 cities studied. St. Paul, however, assesses the entire cost against abutting property on a frontage basis; Denver against a district on a zone basis; Portland against abutting property except corners, which are zoned on an area basis; and in Newark the entire cost is assessed on abutting property.

Sidewalks.—In every city the entire cost of sidewalks is assessed against abutting property in the same way that paving is assessed. In Cleveland and Philadelphia sidewalks are built by the property owner.

Grading.—In 18 cities the cost of grading is assessed by the same method as paving or included in the paving cost. In Kansas City, however, where the topography is rough, only subgrading is included in this cost and main grading is generally assessed against a benefit district. In exceptionally large projects the zoning of districts is used. There is no assessment for grading in Detroit, but very little grading needs to be done. In Indianapolis grading is assessed against a benefit district and may be paid partly by the city at large. St. Paul assesses original grading against abutting property, but large jobs against a benefit district. In Des Moines, when grading is done in connection with street opening and widening, it is assessed against a benefit district; but when it is connected with a paving project it is financed from the general fund. Subgrading is included in paving. Original grading is assessed entirely against abutting property in Newark, and large projects may be assessed against benefit districts created for that purpose.

Street Opening and Widening.—The most common method of assessing for street opening and widening is the creation of a benefit district against which all or at least part of the cost is assessed. In the larger projects it is customary for the city to pay part of the cost.

Sewers.—There is little uniformity in assessing and paying for sewers. One method used is the assessment of lateral sewers and the payment for trunk sewers from bond funds. Another is to limit the assessment against any property to the cost of a sewer sufficient to provide local service to the property, and sometimes the size of the sewer necessary to accomplish this is fixed by law. In some cases lateral sewers are assessed against abutting property and main sewers against a sewer district determined by the drainage area. It is quite common to limit the amount of assessments for sewer construction. Some cities assess on the area basis against sewer districts drained.

Acquisition of parks and playgrounds.—In general the cost of the acquisition of land for parks and playgrounds is met by special assessments. In three cities it is common to pay this cost by assessment against benefit districts. In two others part of the cost is usually assessed by district. In four cities special assessments are allowed but very seldom used.

Park and Boulevard Maintenance.—Kansas City is the only city of the 24 which uses special assessments for the maintenance of parks and boulevards.

Viaducts Over, and Subways Under, Railroad Tracks.—In only three cities besides Kansas City are there special assessments for viaducts and subways made necessary by railroad tracks. In Los Angeles there is a special assessment in some cases; in Seattle in very rare cases a benefit district is created for this purpose; in Portland 20 per cent is usually assessed against a benefit district; and in Kansas City they may be paid for by the railroad, by the city at large, by special assessment, or by some combination of these methods.

Trees.—In 10 cities street trees are planted by the city and assessed against abutting property. In other cities, the trees are either planted by property owners or by the city; in the latter case they are financed from the general fund.

Street Cleaning, Lighting and Repair.—Toledo is the only city that has a special assessment for street cleaning. None of the cities assess the cost of street repair, Kansas City having abandoned the practice in 1923 when the gasoline tax ordinance was passed. For street lighting, 14 of the cities have no assessments; and in the others the cost of original street lighting is paid by the city although ornamental lights and the like are partly or wholly assessed against abutting property.

Water Main Extensions.—No assessment is made for water mains in 13 cities. In two others the water department is privately owned; and in the others a portion of the cost is usually assessed. A common limitation is that not more than the cost of the local mains may be assessed.

Levees.—No adequate information was obtained as to the payment of the cost of levees.

Paving by Street Railway Companies.—In 15 cities the street railway companies pay the cost of paving between the tracks and for a short distance outside. In Philadelphia and Pittsburgh the city is paid a flat sum in lieu of paving. In Baltimore paving is done on part of the system by the railway company. In Indianapolis and Seattle the companies pay the excess over the ordinary cost of paving the area. In Newark the company pays for paving when it lays new tracks and in Denver and Duluth the companies pay no paving cost. There was no information from Milwaukee. In 15 of the cities the companies pay for repaving between and along the outer edges of the tracks. These are the same cities as the 15 listed for original paving, except that Cleveland is omitted and Denver is included. In the remaining eight paving by street railway companies is treated in the same manner as ordinary paving. In 17 cities the companies pay for repairing such paving. In Philadelphia and Pittsburgh they pay a lump sum and in Duluth they pay nothing. In Newark they pay part of the cost and in Baltimore the entire cost on part of the Street railway system. In 14 the company does not pay for the cost of cleaning the street railway areas, and in five it does. Lump sums are paid in Pittsburgh and Philadelphia, and the entire cost is paid over part of the system in Baltimore.

How Is the Contractor Paid?—Payments to the contractor are paid in cash or by tax bills or certificates. For cash payments, funds are raised by the city from collection of assessments, from the sale of bonds or certificates, or from city funds. In the second method, tax bills or certificates are given to the contractor as evidence of the special assessment against certain property. These are in the amount of the special assessment against the specific property benefited and the contractor is responsible for their collection. The cash method is used in 14 cities and the certificate method in five cities. In Philadelphia the certificate method is used except for water main assessments. In Los Angeles it is used in 95 per cent of the cases, and the cash method in 5 per cent. In Buffalo the contractor is paid in warrants payable by the city in from one to five years but callable at any time. In Omaha cash payment is generally used, and in Pittsburgh the contractor is paid by an assignment of the amount due him. The city pays this assignment from special assessments as they are collected, but it must pay the full amount in two years. Unpaid portions of the assignment bear 6 per cent interest.

Assessments may usually be paid in more than one installment unless they are very small in amount. The number of payments varies from one to 20. The interest rate on unpaid assessments ranges from 5 per cent to 7 per cent and sometimes 8 per cent on delinquent installments.

Benefit Districts and Zones.—Boundaries of assessment districts are usually fixed by the council with certain exceptions. Sometimes they are determined by a city board, by some city official, or by a special commission.

Acknowledgment.—The foregoing is an abstract of a report prepared by Walter Matscheck, Director of the Kansas City Public Service Institute.

Effect of Chlorine Treatment on B. O. D. of Filter Effluent

During the past year some investigation was made by the Division of Sewage Disposal of the city of Columbus, O., to determine the effect of chlorine treatment on the biochemical oxygen demand of the filter effluent. The results are summarized as follows by C. D. McGuire, chemist in charge of the division, in the 1927 report:

The test was conducted about as follows: Ten gallons of the liquor to be tested were collected in an earthenware jar. A portion of this was then removed for the determination of the biochemical oxygen demand. The immediate chlorine demand was then determined on a sample from the jar by the method suggested by L. H. Enslow of the Chlorine Institute, using chlorine water and titrating the sample direct with ortho-tolidine on a spot plate as an external indicator.

Chlorine water was then added to the contents of the jar equivalent to the immediate chlorine demand in p. p. m. minus .2 parts. The under dosage was for the purpose of preventing sterilization of the sample. After the addition of the chlorine a portion was then taken from the jar for the determination of biochemical oxygen demand.

These B. O. D. determinations were made for one, two, three and five days at 20 deg. centigrade.

The mean values from 45 determinations are shown in Table I:

Table I

Chlorine demand, 2.32 p. p. m.
Chlorine added, 2.11 p. p. m.

	Biochemical Oxygen Demand			
	1 Day	2 Day	3 Day	5 Day
Untreated effluent	14.2	20.7	25.9	33.0
Treated effluent	4.9	10.2	15.0	19.3
Per cent reduction	65.5	50.8	42.1	41.5

Fig. 1.—Surface Treatment Over Rough Stone Blocks on a Paris Street

Fig. 2.—National Route 20, Chevilly, France, Showing Pentration Macadam Surface Over Old Stone Block Pavement

Fig. 3.—National Route 20 in France. Macadam Resurface 1½ Years Old Over Old Stone Block

How European Worn Out

PAVING practice in European cities differs somewhat from that prevailing in the United States. Some interesting impressions of this work were obtained by Mr. C. L. McKesson, Materials and Research Engineer, California Division of Highways, during a recent trip through the British Isles, France and Germany. We are indebted to Mr. McKesson for the notes that follow.

Surface Treatment Over Stone Blocks.—A very economical method of covering rough stone block pavement is shown in Fig. 1, which is a view taken on a street in Paris. The blocks are first thoroughly washed. They are then covered with an application of about 0.5 gal. per square yard of emulsified asphalt and a covering of screenings ⅜ to ¾ in. in size, using about 25 lb. per square yard. The street should be rolled immediately after the covering is applied. This surface treatment results in a very much smoother street than with the unsurfaced blocks and stands up fairly well under light traffic. For heavy traffic the penetration macadam resurface, as shown in Fig. 2, would probably be more desirable and ultimately more economical.

Macadam Surface Over Stone Blocks.—Figure 2 shows a penetration macadam surface over an old stone block pavement on National Route 20 at Chevilly, France. The surface consisted of ¾ in. to 1½ in. rock spread to a thickness of 2 in. and rolled. The stone chips ⅜ in. to ⅝ in. in size were distributed over the course of stone and rolled in. Emulsified asphalt was applied at the rate of 1.4 gal. per sq. yd. in one application and given a light cover of stone chippings. Rolling was continued until the road was thoroughly compacted. Three weeks after, the surface was washed and the roadway received a seal coat of 0.33 gal. per sq. yd. of emulsified asphalt and another cover of stone chips. It was not rolled after the seal coat. The surface was four months old at the time of taking the photograph. The cost of this surfacing was 60 ct. per sq. yd.

Figure 3 shows a macadam resurface 1½ years old, over old stone blocks on National Route 20 in France.

Penetration Macadam Resurface on Old Macadam Base.—An interesting example of a penetration macadam resurfacing over an old waterbound macadam base is shown in Fig. 4, which is a view of Graft Recke St., Dusseldorf, Germany. This is a heavy traffic street leading to brick and tile factories and much of the traffic consists of motor trucks. The street has two roadways, separated by parking, shown on the left in Fig. 4. It was found difficult to

Cities Utilize Pavements

maintain this street as a macadam road and in 1925 the surface on the half of the street shown in the illustration was scarified, reshaped and then covered to a depth of 1.6 to 2½ in. with clean crushed stone. This stone received a first treatment of 1.1 gal. per sq. yd. of emulsified asphalt and a second coating of 0.66 gal. Between applications it was covered with soft sandstone chips and rolled. After the next application the surface was covered with sand and fine soft gravel. The finished thickness of the macadam resurface is approximately 2 in. At the time the photograph was taken the street had been in use two years and it is said not to have any maintenance in this interval. About 100 streets in Dusseldorf has been treated by the method described above.

Emulsified Asphalt Treatment Over Old Macadam.—Figure 5 is a view of Avenue de la Car at Chateauvoux, France. This street is constructed of an old macadam, which was reshaped in 1926 and covered with 1½ in. to 2 in. limestone to a thickness of about 3 in. This crushed stone was rolled lightly and covered with about 40 lb. per sq. yd. of ¾ in. to ⅝ in. stone chips. A treatment of 1.3 gal. per sq. yd. of emulsified asphalt was then applied, followed by a light cover of stone chips and rolled to a smooth uniform surface. Three weeks later the street was given a seal coat of 0.44 gal. per sq. yd. of emulsified asphalt with a light cover of stone chips. The Avenue de la Car is a main street leading to a depot and receives heavy and continuous traffic. Fourteen months after the completion of the work above described, and about a week before the photograph was taken, the street was washed thoroughly and given an application of 0.33 gal. per sq. yd. of emulsified asphalt and a cover of about 17 lb. per sq. yd. of stone chips.

Surface Treatment on Old Macadam.—The illustration, Fig. 6, shows a surface treated macadam on a Paris street after 16 months' service. The waterbound macadam in this case was cleaned with water and brooming and was treated with 2 qt. of emulsified asphalt per sq. yd. The street is adjacent to warehouses and factories and is used almost continuously by truck traffic. After 16 months the surface coating was beginning to wear through in spots, but was not broken or potholed. The recommended retreatment of such work consisted of cleaning the surface thoroughly and of applying a fresh application of about 2 qt. per sq. yd. of emulsified asphalt, followed with a covering of stone chips in the amount of 15 to 20 lb. per sq. yd.

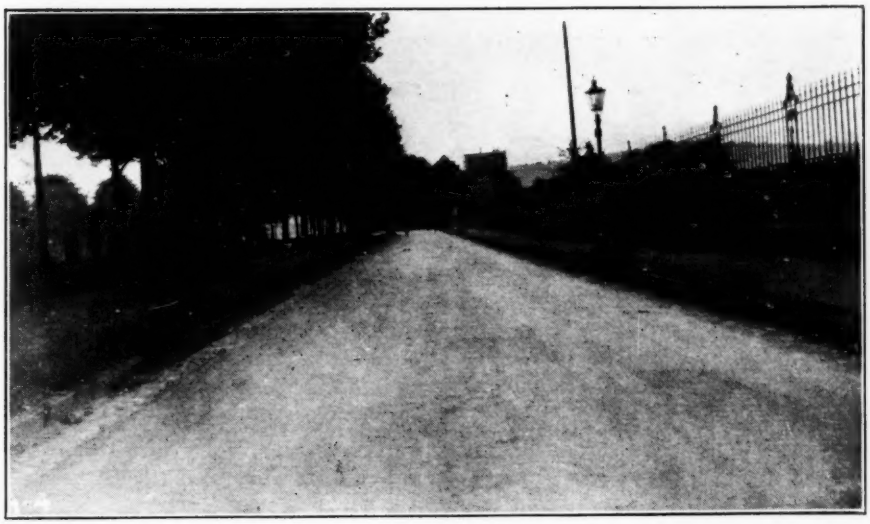


Fig. 4.—Graf Recke St., Dusseldorf, Germany, Showing an Interesting Example of a Penetration Macadam Resurfacing Over an Old Waterbound Macadam as a Base

Fig. 5.—Avenue de la Car, Chateauvoux, France. Emulsified Asphalt Treatment Over Old Macadam

Fig. 6.—Surface Treated Macadam on a Street in Paris After 16 Months' Use

Fire Hydrant Rental Bases Mostly Arbitrary

Replies to Questionnaire Sent to Water Works Superintendents

TO help along the general study of public fire protection service, Municipal News & Water Works sent out a questionnaire to some eighty waterworks superintendents, about half privately owned plants and half municipally owned, from whom we wished to get a statement of the basis used in computing fire hydrant rentals. The results of the questionnaire show that of all but one of those plants reporting, the charge was arbitrarily established.

There are three general methods employed for paying for public fire protection service, viz.: (a) hydrant rental, (b) charge per mile of pipe (4-in. or 6-in. and larger) with an allowance per hydrant for maintenance, (c) charge per inch-foot of pipe (4-in. or 6-in. and larger) with an allowance per hydrant for maintenance. The first one of these methods predominates to such a degree it was thought that perhaps there was some definite basis upon which the charge was computed. The cost of installing hydrants on existing lines as well as on extensions and in new developments or subdivisions is handled differently throughout the country.

The table on this page was compiled from the replies which were received from the questionnaire sent out.

It would perhaps be interesting to read the various replies for data which a table naturally obscures. They follow:

Fairhaven, Mass.—Ours is a private company. The town pays us $50 per hydrant per annum, which we think is too low. In new developments which do not offer sufficient revenue we have petitioners sign a contract guaranteeing 12 per cent on cost of mains and hydrants for 10 years.—H. T. Gidley, Supt.

Baltimore, Md.—There is no charge made for the use of fire hydrants in the city of Baltimore. This Bureau is financed on the budget system, which is appropriated from the general city funds. The difference between the water service revenue received and the operating expenses (of which the use of fire hydrants is one item) is taken from the tax levy.

The cost of installing new fire hydrants is included in the construction cost of the distribution system and is financed out of the Water Loans, for which the interest and sinking funds are taken from the general city funds, including water service revenue and tax levy.

We charge a fire hydrant rental of $36 per annum for fire hydrants on city owned mains in the Metropolitan Dis-

Hydrant Rental and Construction Cost Basis

Town State	Ownership	Hydrant Charge Basis	Hydrant Charge Per annum	How New Construction Costs Paid	Remarks
Baltimore, Md.	M	Arbitrary	$36[1]	Water loans[3]	Charged to construction costs of distribution system
		Arbitrary	$24[2]		
Knoxville, Tenn.	M	Arbitrary	$45	Paid by separate account out of water department revenue	Not assessed to property
Charleston, S. C.	M	Arbitrary	$50	Charged in with distribution system construction cost and paid by water department revenue	Hydrants in excess of 600 bring return of $25 each
Providence, R. I.	M	Arbitrary	$30	Charged in with cost of distribution system and paid by general fund	
Sacramento, Cal.	M	Arbitrary	$1 per mo.	Charged in with whole cost and paid by general bond issue	
Thompsonville, Conn.	P	Contract	$25 to $50	Investment about 10 times annual rental charge	Town pays for cost of installation in excess of 10 times rental
Oskaloosa, Ia.	M	Arbitrary	$50	General waterworks fund	
Selma, Ala.	M	Arbitrary	$45	Water department revenue	No assessments made for new construction
Bluefield, W. Va.	P	Contract	$100 on new lines	Paid by company	State commission fixes rates
		Contract	$22.50 on existing lines		
Mountain Home, Idaho	M	Arbitrary	Amt. not stated	No new construction	
Rumford, Me.	P	Flat charge of $10,000 per year made on corporation 108 hydrants in service now. New ones added without additional charge			
Kansas City, Kan.	M	Arbitrary	$35	Water department revenue	Department has about 1,500 hydrants in service
Salisbury, N. C.	M	Arbitrary	$35	From water department revenue and bonds provided by city as whole	Total amount charged city is less than 20% of total revenue
Springfield, Mo.	P	Contract	$60	By company	One hydrant authorized for each 600 ft. of extension
Fort Collins, Colo.	M	None		In with distribution system and assessed to property	New hydrants on existing lines paid for by water department revenue
Pocomoke City, Md.	M	None		Borne totally by city	
Carroll, Ia.	M	None		Paid by city in general	
Leavenworth, Kan.	M	Arbitrary	$75	Water department revenue	
Elkhart, Ind.	M	Arbitrary	$4 per mo. to city, $5 per mo. to private concern	Water department revenue and bonds	Charged in with cost of distribution construction cost of distribution system
Kewanee, Ill.	M	Arbitrary	$30	Charged in with account of distribution system and assessed to abutting property	City pays 25% of all improvements
Anthony, R. I.	P	Contract	$25	Paid by company	Hydrant installation charged in distribution system construction cost
Fairhaven, Mass.	P	Contract	$50	Paid by company	On new developments company has petitioners guarantee 12% of cost of mains and hydrants for a period of 10 years

Footnotes:

[1]This charge is for fire hydrants on city owned mains in the Metropolitan District outside of the city limits. It is compiled as follows:

$ 6.00	Operating and maintenance expense
15.00	Interest and sinking fund on investment
15.00	Water service and readiness-to-serve charge
$36.00	Fire hydrant rental per annum

[2]Special charge to Metropolitan Commission because they float bonds to pay for installation construction costs and carry interest and sinking fund charges. They assess abutting property 15 ct. per foot to cover interest and sinking fund.

[3]Interest and sinking fund for these loans are taken out of the city general fund.

trict outside of the city limits. This charge is compiled as follows:

$ 6.00	operating and maintenance expense
15.00	interest and sinking fund on investment
15.00	water service and readiness-to-serve charge
$36.00	fire hydrant rental per annum

The Metropolitan Commission also installs mains and fire hydrants in the Metropolitan District for which they float bonds and assess abutting property 15 ct. per front foot to cover the interest and sinking funds. The city receives a rental of $24 per annum for these fire hydrants. The difference between the two rental rates ($12) represents a reduction allowed the Metropolitan Commission for financing the installations and carrying the interest and sinking funds.—Edward G. Rost, Water Engineer.

Fort Collins, Colo.—You ask on what basis our hydrant rental is fixed. Will answer, we have no rental charge.

You ask how we assess new construction fire hydrant costs, whether in the cost of construction to be assessed on the front foot basis or as a levy on the city as a whole. Will answer that unless the hydrants come in as a part of a regular water improvement district they are charged out of the regular waterworks department fund, otherwise as a part of the cost of a particular improvement district, to be charged to the property specifically benefited in the district.

For your further information, will say that our waterworks is municipally owned.—E. A. Lawson, City Engineer.

Charleston, S. C.—The question of hydrant rental charges is very much one of "Topsy"—that is, it has just grown up.

In our case at Charleston, the municipal department pays us a fixed sum for a number of fire hydrants, which includes the use of 300,000 gal. of water per day for municipal purposes, flushing sewers, sweeping streets, police station, city hall, etc. Neglecting the use of water this nets us about $73.30 per hydrant, but the 300,000 gal. on our regular schedule of rates amounts to $13,900 per year, which deducted from the contract amount, would reduce the amount paid for hydrant rental to $50 per annum.

For all hydrants in excess of the first six hundred, we charge a flat rate of $25 per hydrant, which just about carries the cost of maintenance, depreciation, and interest on the hydrant installation.

In making extensions for real estate developments, etc., we charge the cost of setting hydrants, including the cost of hydrant and hydrant leads, right into the cost of the extension. Of course, we keep a detail of this cost, but so far as the plant account is concerned, there is no distinction made. Rental on these hydrants is the same as for public hydrants provided they are located on the public highways; however, if they are put in private ground off the highway, we make a charge for the size main leading into the property, and the property holder can put as many hydrants on this main as he sees fit. All water, however, passes through and is measured by Protectus type of meter, and we make no charge based upon the number of hydrants.

The Water Department pays for all mains, valves and hydrants in the streets if laid within the city limits on developed streets, but in new developments we require the real estate development company to pay the cost of these developments, and then as consumers are obtained we reimburse the development company a pro-rated or agreed amount, depending upon the size of service and the minimum guaranteed yearly rental.—J. E. Gibson, Manager and Engineer.

Kewanee, Ill.—We make a charge of thirty dollars per hydrant per year against the city, which is credited to the Water Department. The costs for new fire hydrant construction is charged in with the cost of construction of the distribution system, and the whole thing is assessed on a front foot basis against the abutting property. The city standing twenty-five per cent of all public improvements.—R. M. McKinley, Assistant Superintendent Water Works.

Elkhart, Ind.—Public fire hydrant rental is $4 per month, paid by the civil city; private fire hydrant rental is $5 per month, paid by the consumer. We charge the costs of construction in the distribution system and all of our constructions are direct liabilities of the waterworks paid from proceeds of bond issues or from revenues. The civil city does not stand any part of the cost. —J. R. Stephenson, Superintendent.

Leavenworth, Kan.—Our water department charges the city the sum of $75 per annum for each fire hydrant installed. This however, is an arbitrary charge and is not based on any particular basis. We figure that the city should pay us for the privilege of having ample fire protection at all times and the water as well as the fire hydrant is there for their use at any time.

This amount of rental paid to the water department is provided for by a tax levy and is paid by the general taxpayer to the city treasurer and in turn is paid over to the water department when we present our quarterly statement for hydrant rental.

The water department installs the fire hydrants at their own expense and this does not cost the city any extra, but is charged in on the cost of construction of our distribution system.—Chas. F. Linck, Superintendent.

Anthony, R. I.—Ours is a private plant. Hydrant rentals are $25 per year. All hydrant installations are charged to construction. We do not (in fact, cannot) under our contracts charge fire line extensions to the abutting property.—J. W. Money, Superintendent.

Carroll, Ia.—We have a municipal plant and make no charge for hydrant rental except to private individual, circuses, etc. New fire hydrant construction costs are charged in the extension costs.—H. W. Badley, Water Superintendent.

Pocomoke City, Md.—We do very little in way of fire plug rentals. What little is done is on a temproray estimated arrangement. We have no assessment on fire plug installations. The city assumes the total cost. Our plant being municipally owned, the cost of installing and maintaining is borne totally by the city.—R. H. Robertson, Superintendent.

Springfield, Mo.—This company is privately owned, and we have an arrangement under our agreement with the city to install a fire hydrant for every 600 ft. extension of 6-in. or larger main. In other words, the city can authorize or direct us to install fire hydrants either on existing mains or at new locations, requiring extensions of not more than 600 ft. for each fire hydrant ordered. We receive in return for this extension a rental of $60 per year from the city, but no charges whatever are made to property owners or the city for the construction work.

The entire cost of the construction is entered into our distribution system account, which is a plant charge.

For new services we allow the consumer 75 ft. for each new service, or that is, inside or outside the city limits, anyone desiring service not within the reach of present mains is allowed 75 ft. free of extension for each service and a cost of 45 ct. per foot for the balance. —William J. Gray, Superintendent.

Salisbury, N. C.—We do not actually collect anything through taxes from the city for fire hydrant rental, street flushing, or sewer flushing. However, the city does pay the interest on bonds and takes up the bonds as they fall due. So to cover this situation we set up a charge against the city for this service and then credit them for the service they render in handling the bonds. On this basis we figure the hydrant rental amounts to approximately $35 per hydrant per year.

The new construction work, whether for hydrants or otherwise, is paid for from our revenue or through bonds provided by the city as a whole. We do not assess any main line costs against the property, but if a small service stub is put in on account of paving the tap fee as assessed along with the paving costs and the water department collects when the work is done from the paving account.

The total amount we charge against the city for hydrant rental, street and sewer flushing amounts to less than twenty per cent of the total revenue for the year.—J. O. Craig, Superintendendent.

Kansas City, Kan.—Our department

has approximately 1,500 fire hydrants for which they receive $35 per hydrant per year, which is paid out of the Protection of Life and Property Fund of the city government.—H. T. Barclay, Superintendent of Water.

Rumford, Me.—We charge the cost of installation of hydrants to our Plant Account and then charge the Rumford Falls Village Corporation a flat rate of $10,000 per year. At the present time there are 108 hydrants in use by the corporation and we add necessary ones without additional charge. Ours is a private plant.—F. O. Walker, Superintendent.

Mountain Home, Idaho.—Hydrant rental was fixed by a former Board of Village Trustees and same followed to date. No one knows the basis upon which it was originally fixed. We have had no new construction in fire hydrant extension for a number of years; think it was taken care of by assessment by the town as a whole.—A. F. Anderson, Village Clerk.

Bluefield, W. Va.—Hydrant rentals for this property have been fixed by State Commission, basing the charges for fire protection service on the investment in plant for such service over and above the investment that would have been made to furnish water service without fire protection.

The city pays us a fixed charge for hydrants as of a certain date. On all new hydrants ordered in on new extensions laid for such service, we collect at rate of $100 per year regardless of size of hydrant.

On all new hydrants ordered in city on existing lines, city pays us rental of $22.50 per year.—S. L. Rhoods, Superintendent.

Selma, Ala.—We charge $45 a year rental for fire hydrants. As to how we arrive at a basis beg to say that we simply charge this, as we consider it a fair rental, and it is, I understand, what most water companies charge.

We make no assessment against the property or the city or anyone for fire hydrants where the consumption of water is sufficient in any location to require a water main. When this main is laid fire hydrants are placed not farther than 500 ft. apart and there is no charge made for them, the water company furnishes them.—R. Coleman, Manager.

Oskaloosa, Ia.—We make a charge to the city of $50 for each fire hydrant. The construction cost is paid out of the General Water Works Fund and there have been no mains laid here yet under the assessment plan. We believe the assessment basis is probably the most fair way if the law could be simplified enough to be practically used with a small office force which is accorded our water works department.—H. C. Hawkins, Superintendent.

Thompsonville, Conn.—Our hydrant rentals are based on a fixed sum per hydrant, ranging from twenty-five dollars to fifty dollars. We will invest in construction for additional hydrants, including necessary extension of main required, an amount equal to about ten times the annual hydrant rental charge.

Should the cost of the hydrant including main extension exceed this amount it is paid for by the town. This is a private company.—Walter P. Schwabe, President and General Manager.

Sacramento, Cal.—The charge for hydrant rental is one ($1) dollar per month per hydrant. This charge is made against the fire department.

Hydrants are installed when extension work is carried on and financed through general bond issue.

Sacramento has municipally owned water.—J. I. Prugh, Superintendent.

Providence, R. I.—The yearly charge of each fire hydrant is $30 per year, for city or town.

The cost of construction of fire hydrants is charged in cost of construction of distribution system:

Water pipes are laid in streets under the following city council resolution:

RESOLVED, That the Commissioner of Public Works is requested to reject any application for water pipes to be laid in the streets of the City of Providence and adjoining towns unless the estates abutting upon said streets are sufficiently built upon to ensure an annual income from the sale of water to be not less than seven per cent of the cost of the water pipes and the laying thereof. Wherever owners of land that is not built up enough to pay said income desire to have water pipes laid, they may have such work done by the city by depositing with the City Treasurer a sum of money sufficient to cover the cost thereof. And if at the expiration of ten years or less from the time said pipes are laid there shall be a sufficient number of takers of water who shall annually pay into the City Treasury a sum of money equal to the amount required by the city, if said city had furnished and laid the pipes at its own expense, then said city shall pay to the owners of said pipes the amounts that were paid by them into the City Treasury.—Ornam L. Patt, Jr., Secretary.

Knoxville, Tenn.—When the water plant of the City of Knoxville was owned by a private corporation, the Court authorized and permitted them to charge the city $45 per annum per hydrant, for public hydrants installed. In setting up the fire hydrant rentals contained in the Rates, Rules and Regulations, approved by the Council, May, 1925, the city officials in charge of the Water Department simply revived the rental authorized and paid to the private company. We checked this charge and found it was a fair average of other cities.

New fire hydrants installed are paid for by the Water Department of the City of Knoxville out of its own revenue. The cost is not assessed against the abutting property or any other institution, but entirely against the Water Department revenue as set up in its own budget.

The cost of installing new fire hydrants, as well as maintenance and repairs to old fire hydrants, are charged to a separate budget item in the Water Department's budget, and not to the distribution system construction costs, and not through an assessment on front foot basis against the abutting property or in any other way.

We know that the above procedure is not that followed by a number of other municipalities, or by a number of privately owned water works.

The Water Department in Knoxville is in debt to the general fund of the City for deficits arising prior to existence of the present city manager form of government on Oct. 1, 1923, and subsequent to the purchase of the privately owned plant in 1909. The fire hydrant rental therefore, which is annually charged against the City by the Water Department, becomes a bookkeeping account only and is applied to the general reduction of the Water Department debt to the City. What will happen when the Water Department's debt to the City is finally paid in full, remains to be seen.

At the present time the people of Knoxville consider the fire hydrants as a part of the fire fighting equipment and covered by the taxes they pay to the City for fire, police, streets, sewers, etc.

From my knowledge and experience, the majority of cities throughout the United States, regardless of whether the Water Department and water works is owned by the City or by private corporation, have fire hydrant charges which have no more logical basis for existence than that here in Knoxville.

The Indianapolis Water Company, 113 Monument Pl., Indianapolis, Ind., F. C. Jordan, Secretary, is operating, however, under an entirely different order of affairs. The State Public Service Commission passed regulations effective January 1, 1925, which makes the City pay for public fire hydrant service on the inch-foot basis.—Frederick W. Albert, Engineer in Charge of Water Department.

Cities Defining Their Metropolitan Areas.—In preparation for the forthcoming census of 1930, 72 cities are defining their metropolitan regions in order that the returns may be compiled hereafter to show the rate of growth for such units. Among the cities defining such areas, reports the Civic Development Department of the Chamber of Commerce of the United States, are New York, Chicago, Detroit, St. Louis, Philadelphia, St. Paul, Minneapolis, Dallas, Buffalo, Rochester, Kansas City, and others. Twenty-one metropolitan-area maps are in preparation or have been made.

Pulling the Cork From a City's Bottle-Neck

How San Francisco Opened Up Its Main Outlet

ONE of the most outstanding pieces of highway construction yet built by the California State Highway Commission, and the widest cement concrete "super-highway" on the state system has recently been completed on the El Camino Real south of San Francisco. The stretch extends for approximately 1½ miles between Colma and the Cypress Lawn Cemetary, formerly a section notorious for its ability to congest traffic in the narrow defile. Due to this notoriety the section gained the name of the "bottleneck highway."

City's Main Outlet.—This is a section of San Francisco's main outlet and the only state highway serving the city. It has the record of being the heaviest traveled road in the entire state of California, a count indicating a volume of 20,000 vehicles per day. The pavement selected for the improvement is one of the heaviest built to date—a thickness of 9 to 11 in. of Portland cement concrete. The improvement consists of two 30 ft. strips of pavement, one on each side of the Market Street Railway Company tracks. This width allows for three lanes of travel in each direction with a 10 ft. allowance for each lane. Predictions that the road would carry future traffic with increased speed and safety are being borne out.

Total Cost $700,000.—The cost of right-of-way, grading and realigning the road was the major item of cost in the total improvement which approximated $700,000. Many months were taken after the dedications were completed to move buildings and other obstructions. Realignment of all the poles of the railway, telegraph and telephone companies greatly improved the appearance of the highway.

124 Ft. Right-of-Way.—The first contract was let in October, 1926, for rough grading and moving buildings, etc. This award was made to the Kaiser Paving Co., of Oakland. The improvement provides for a right-of-way of 124 ft. and in some cases whole blocks of substantial buildings were moved. During all the grading and moving work, traffic was maintained over properly surfaced roadways. The organization of this part of the work was one of the features of the project during construction.

Contract for paving the highway was awarded June 23, 1927 to the Hanrahan Co., contractors, of San Francisco. The width of the former road was only 24 ft. for traffic in both directions and when the paving operations were started it was an unusual sight to view the narrow sufaced portion of the wide, spacious right-of-way. With the 24 ft. roadway congested, the sight was conclusive as to the value of wide, straight highways with ample pavement surface.

With the procedure of the work, the Market Street Railway Co. moved its tracks to a 28 ft. section at the center of the right-of-way. The tracks were ballasted in rock and not paved. A curb along the pavement prevents travel in the railway area except at specified crossings.

Construction Methods.—On each side of the track area, there was constructed a 30 ft. portland cement concrete pavement, consisting of three 10 ft. strips, each 9 in. thick in the central 6 ft. and increasing from 9 to 11 in. at the edges. The strip adjacent to the center was built to a width of 10 ft. 9 in., the additional 9 in. being for support of a concrete curb doweled to the pavement base.

Each 10 ft. strip was placed and cured before the adjacent strip was placed, to facilitate finishing operations. Materials were batched direct in compartment trucks from bunkers which had been set on a railway siding near the center of the work. The batches were hauled to a 6-bag Multifoote

View of Colma-Cypress Lawn Highway Improvement

The Improvement Provides Two 30 Ft. Strips of Pavement on Each Side of the Railway Tracks

paver which traveled along to place the concrete directly in the 10 ft. strips. One of the first operations was to pave the section in a new line change to permit the moving of tracks and allow travel to use the new portion quickly. At the same time eliminations were made of two dangerous track crossings.

Expansion Joints 60 Ft. Apart.—The design of the concrete pavement provided for expansion joints at 60 ft. intervals. Adjoining slabs at these points were doweled together with five ¾ in. by 24 in dowels through the premolded filler. These dowels were so placed as to be fixed at one end and permit movement in the other end. At 20 ft. intervals between expansion joints, weakened plane joints were constructed to obtain a straight transverse natural crack line; therfore each 10 ft. by 20 ft. portion of the pavement is separately reinforced. The weakened plane joints were formed by slotting the pavement surface and inserting in a vertical position a metal strip ¼ in. thick, 2 in. wide and 10 ft. long. After finishing operations had passed over, the strip was pulled to the surface and left to protrude about an inch until the pavement had set. The pavement was edged at these points and the slot filled with hot asphalt before being opened to traffic.

Pavement Reinforcement.—Reinforcement consisted of marginal bars in each 20 ft. panel of two ⅝ in. deformed bars laid 4 in. from the sides of the strip and the same distance from the expansion or weakened plane joints. 30 ft. bars were used and where joined were lapped 40 diameters. In one section where the new construction topped old pavement, the concrete was reinforced with ⅜ in. square deformed bars laid in mats with 12 in. spacing.

Finishing and Curing.—Finishing operations involved the use of strike boards and tamper, and floating with longitudinal float 16 to 18 ft. long operated across the pavement with the length of the float parallel to the center line of the pavement. The final finish was made with another float built of lighter wood, 16 to 18 ft. long, equipped with reversible handles. This floating was done when the concrete became slightly sticky to produce the best in non-skid finish.

Curing followed with an earth cover and ponding for eight days. Strips were opened at 14 days provided the modulus of rupture was at least 400 lb. per square inch as determined by flexure tests. Specimens for the test were cast 7 to 10 in. and 38 in. long, and three specimens were made for each ½ miles of pavement.

The construction of the "bottleneck" highway was a cooperative project with combined sharing of costs between city and county of San Francisco, County of San Mateo and the Market Street Railway in amounts of $150,000, $50,000 and $55,000 respectively. The construction was done under the supervision of District IV, California Highway Commission, J. H. Skeggs, District Engineer.

Patrol Street Cleaning at Toronto, Ont.

Extract from 1927 Report of George W. Dies, Street Commissioner of Toronto

The streets are the show windows of the city. Any neglect to keep them well paved or reasonably clean is apparent to all who use them, but particularly to visitors. We therefore should not be too sparing in the maintenance and performance of these important duties. The patrol work is perhaps the most important branch of the street cleaning service, which embodies as well the flushing of streets, the cleaning of culverts, the oiling of unimproved roadways and the removal of snow.

The downtown business area and main business thoroughfares are under the patrol system; that is, each patrolman has a defined area to patrol, which may be covered from one to eight times a day, according to its requirements. Each patrolman is provided with a paper-picking bag, push cart, broom, scraper and shovel. He covers his beat on the first round each morning with the paper bag and removes all loose paper which may be on the boulevard, walks, or roadway. He then commences his rounds, removing all street dirt which is deposited in the push cart. As the tubs are filled, they are left at a designated point, to be later picked up by a truck.

The remaining sections are under the squad system; that is, the men work in pairs, one on each side of the roadway, followed by a pick-up vehicle. This system is carried out in the residential and outlying sections. The various districts receive a cleaning once or twice weekly according to its requirements and the funds available.

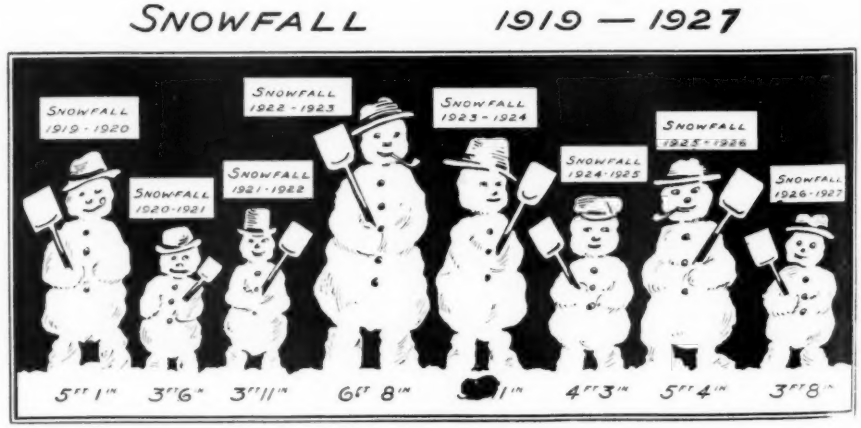
The streets of Toronto, prior to 1916 received constant cleaning, each patrolman having an average of 1.4 miles of street to maintain. This average has, however, increased each year, due to reduced estimates and a gradual increase in the wage rate, so that today the average mileage maintained by each patrolman is 3.4 miles, covering approximately 42,000 sq. yd. While there was an increase from 167 patrolmen in 1926 to 175 in 1927, it was not sufficient to cope with the new districts which have been developed during the year. The average mileage maintained by each patrolman is greatly in excess of the mileage that can be properly maintained by one man.

Statement Showing the Unit Cost of Handbroom Sweeping of Improved Roadways for 1927

Total cost (foremen, labor, cartage, supplies)	$262,939.44
Area of improved street mileage (square yards)	7,494,857
Cost of maintenance per 1,000 sq. yd. per season	$35.08
Amount of sweepings collected (cubic yards)	95,042
Cost per cubic yard (sweeping, collecting and removing)	$2.75
Cubic yards removed per 1,000 sq. yd. per season	12.9
Number of patrolmen	175
Average area maintained per patrolman (square yards)	41,898
Average number of times swept per season	90
Cost of sweeping per 1,000 sq. yd. (sweeping, collecting and removing)	$0.889

The Typhoid Fever Carrier Again Gets a Job in the Dairy

The Secretary of the Department of Public Health of Vermont reports an epidemic of typhoid fever in the city of Rutland, Vt., from March 25 to April 14, 1928, which was traced to a healthy carrier employed in a dairy. There were 15 primary cases, 1 secondary case, and 3 deaths. The carrier was 63 years of age and gave a history of typhoid fever when about 15 years old. Eighteen years ago he developed cholecystitis and was operated upon with the removal of a number of gallstones. Since that time he has been apparently well.



Yes! It Snows at Toronto, Ont. Here is a Graphical Representation of Just How Much It Snows. Used by George W. Dies, Street Commissioner, in His Annual Report to Show Comparative Snow Falls Since 1919

Maintenance of Sanitary Sewers and Storm Drains

Methods Employed on Sewer System of Baltimore, Md.

By Milton J. Ruark
Sewerage Engineer, Bureau of Sewers, Baltimore, Md.

THE need for maintaining sewers and drains is usually the result of one or more of four causes: Poor design, poor construction, depreciation, and in some respects the most important of all—misuse.

Poor Design.—The question of the poor design of sewers in Baltimore, where careful study and thought are devoted to relatively unimportant sewer projects, is practically of no importance in so far as the maintenance of the sewers is concerned. Care must be given in selecting the proper materials for construction, and sewers of adequate size and strength should be planned. Except where unusual problems present themselves, the planning of sewers and drains has become so standardized that there is little excuse for poor designs.

It is fortunate that practically the whole of the sewerage system of Baltimore has been planned and built as one project during the past 20 years at a time when the theories relating to sewer design had been perfected. The result has been that the sewers have been adequate in size, and it has not been necessary to replace the materials of which they were built. The most conspicuous case where a more desirable design would have been preferable relates to storm water inlets at street intersections. Many of the covers on these inlets are broken and crushed by trucks or vehicles hitting or running over them. Inlet covers formerly had a radius of six feet. The remedy has been to increase this radius to 10 or 15 ft. This change in design not only corrects the difficulty, but also permits vehicles in the street to turn at corners with greater ease.

Poor Construction.—It is as essential to have good construction as it is to use careful design in order that maintenance costs may be kept at a minimum. Two of the most essential things to watch in the construction of sewers is to see that the material used for backfill is thoroughly compacted under and around the pipe and that the joints are well made. The former precaution will add much to the strength of the sewer, and tend to prevent failures.

A Root Proof Joint.—Tight joints not only reduce the quantity of ground water entering the sewers to a minimum but also help to exclude tree roots. Fully 35 per cent of the chokages in the sanitary sewers of Baltimore are due to the roots of poplar and willow trees. Many times roots grow long distances to reach sewers. The roots of oak and similar shade trees have never been known to give this trouble. In each place where a sewer becomes choked because of tree roots the joints, through which the roots have passed, are remade with great care. First, a ring of jute is inserted in the bell of the pipe the same as when the usual Portland cement joint is made. Then red and puddle clay, to which has been added a liberal quantity of coarse salt, is packed over the jute to within about ½ in. of the end of the bell. On top of this is placed a mortar of cement and sand. This type of joint has proved effective since none has ever been replaced because of the entrance of tree roots. Fortunately, this problem is getting better, as there is now a city ordinance which prohibits the planting of poplar trees on public highways.

Maintenance Due to Depreciation.—The maintenance required to keep a sewer system in first-class condition is usually not great, especially if the system is new. However, there are numerous factors which tend to increase the gradual depreciation of sewers. Other public utilities such as gas and water pipes, electric conduits, etc., are often constructed in trenches adjacent to the sewers, and not infrequently the latter are damaged due to a settlement of earth or other causes. It is sometimes weeks or months before the trouble is discovered and rectified.

The tapping of sewers by plumbers to provide for additional house connections often causes trouble that makes itself evident by a chokage near the tap. One way to remedy this difficulty is to inspect thoroughly every new connection.

A great deal of the general maintenance work consists in replacing noisy and broken manhole covers and making repairs to inlets. Where sewers are well designed and constructed, and are not old, little money need normally be appropriated or spent to remedy wear and tear.

Maintenance Due to the Misuse of Sewers.—Although a sewer system is designed to have a very limited use, it usually becomes the repository for almost every conceivable object of moderate size. If a man gave so little thought to his telephone or electric light service as to the use of the sewer system, neither of these public utilities would function as well as they now do. The following is a list of some of the things which have been removed from choked sewers: Hatchets, bricks, bird cages, corn cobs, flat irons, pick handles, dish pans, shoes, oyster shells, table spoons, broom handles, whiskey flasks, brushes, garden hose, coffee pots, dead cats and dogs, dolls, etc. It seems inconceivable how some of these objects get into the sewers. Pick handles, which are frequently found in sanitary sewers, have most likely been left there by some laborer after the completion of the sewers.

Maintenance of Storm Drains.—One of the first rules that must be followed in order to reduce the maintenance of storm drains is to keep the streets clean. Unless this policy is followed the debris on the street is washed into the drains after the first heavy rain, where it often has to be removed at considerable cost.

Furthermore, the material at dumps, the drainage from which flows into the upstream end of storm sewers, should be kept from rolling or obstructing the drains.

Some few years ago quantities of dead fish, which decomposed and gave off odors, were found in the drains adjacent to some of the markets. It was learned that these fish were washed into the storm sewers, usually late at night, when the markets were being cleaned. Since this practice naturally created a good deal of trouble, the markets were patrolled for a short length of time, and the difficulty was remedied.

Disposal of Snow Into Drains.—In most large cities the disposal of snow into storm drains has become a generally accepted practice. Frequently the snow has mixed with it garbage, ashes and debris found on the streets. The snow melts in the drain and often leaves these foreign materials, which have to be eventually removed, stranded on the bottom of the sewers. Large drains should be selected for the disposal of snow, and liberal quantities of water used for flushing purposes. A 36 in. drain in Centre street became completely blocked with frozen snow last winter, and considerable difficulty was experienced in removing the material.

Disposal of Oil and Gasoline in Drains.—One of the most serious problems that confronts engineers who have

charge of the maintenance of sewerage systems relates to the disposal of gasoline and oil from automobile crankcases into the sewers. The problem is an ever present one not only in Baltimore but also in practically every large municipality in the country. Many cities have had serious explosions because of the ignition of gasoline in the sewers. On June 8, 1926, there was an explosion and fire in the Jones Falls drain, but fortunately, no serious damage resulted.

Immediately after the fire, efforts were made to enforce the ordinance which prohibits the discharge of oil and gasoline into the sewers. Many inspections were made of those drains and sewers tributary to that portion of the city where there were large numbers of automobile establishments. As it was impossible to police each public garage in the city, conditions were not improved. It was recognized that the only remedy was to provide the garages a way of disposing of the spent crank-case oils. As a result the city entered into a two-year contract with the Provident Oil Service at a cost of $3,240 a year for disposing of the oil from garages and similar places. This company collects the oil at regular intervals and disposes of it.

Cleaning Large Drains.—A minimum of time and money is spent in order to remove the material which settles in large drains. The velocities in them during dry weather are such that there are considerable deposits. The first heavy rain, however, flushes out this sediment, and the problem solves itself.

As a general thing there are practically no odors coming from storm drains. Occasionally there are odors from a few inlets, caused by a dead animal or other decomposing material being present. Disinfectants and deodorants are used at times when odors are pronounced.

There are certain drains and also sanitary sewers, the design and construction of which require frequent inspection and attention to see that they are in good working order. Where the grades are flat, the deposits are removed, and where the drain is rapidly deteriorating, repairs are made. By having regular inspections made of these drains, much trouble is obviated. A group of five men with one truck devote all their time to cleaning large storm sewers and reporting their condition.

Maintenance of Sanitary Sewers.—The maintaining of the sanitary sewers usually consists of removing obstructions from the smaller pipes—usually 8 and 10 in. in diameter. On rare occasions a 12 in. sewer will become clogged, and only once or twice during recent years has a 15 in. sewer been obstructed. Where the larger sewers require cleaning, it is usually due to wastes from industries. As is the case with oil, adequate means where possible should be provided to dispose of this waste material other than in the sewers. Much can be done in a cooperative way. For example, Baltimore has a number of factories where tomatoes are canned. Many of these establishments used to dispose of the tomato skins into the sewers until they were notified that this practice was illegal and created considerable trouble at the sewage works.

All obstructions in main line and house sewers up to the building line are removed by the city. On the other hand, chokages in the house sewers inside the property lines are removed by a plumber employed by the property owner. This rule, although a rigid one, is not necessarily adhered to in emergencies. In case the difficulty is due to the carelessness of the property owner he is required to pay for all of the expense involved.

The majority of sewer obstructions are in those sections of the city with a large foreign population. In Roland Park, for instance, the number is relatively small in spite of the fact that many of the sewers are 6 in. in diameter, and are built in curves between man-holes.*

The sanitary sewers of Baltimore are free from objectionable odors. The reason is that sewers have good grades, and are ventilated by the house stacks on each building. Sewers that are free from odors because of good ventilation are good insurance against explosions. Moreover, they can be cleaned without hazard to workmen.

Cleaning Tools.—A wise selection of cleaning tools greatly decreases the cost of maintaining sewers. The first essential is to have good cleaning rods. Two types are used in Baltimore. The rods used to clean out storm drains, are made of wood, 3 ft. long, octagonal in shape, and about 2 in. thick. They have the advantage of being strong, and at the same time sufficiently light to float on the water while they are being shoved through the drain.

The other rods, which are used to clean sanitary sewers, are 4 ft. long with a cross-section of 1⅛ x ⅞ in. Other tools, such as scoops, root cutters, etc., are also of value. One of the greatest time and money saving devices for cleaning sewers has been flexible steel cables. They are narrow but strong ribbons of steel, which are used primarily to clean house sewers. At the end of the cable there are two small steel rollers, which increase the ease with which it can be forced through the sewer. The use of this cable has saved property owners thousands of dollars, which formerly was spent in tearing up and replacing the sewers.

Personnel.—The cleaning of the sanitary sewers and storm drains is under the supervision of one man. As previously stated, there is one gang of 5 men with a truck which spends all of its time in cleaning large storm drains. There are 4 additional gangs with 4 men in each gang—each provided with a truck—which clean inlets, report and replace broken and noisy manhole covers and do other work. Each of these gangs is alloted a section of the city, which it particularly patrols and is responsible for. There is, moreover, a gang of 9 men, which makes repairs both to storm drains and sanitary sewers.

The sanitary sewers are maintained by 9 groups of men. Four of these groups, consisting of 18 men and 2 foremen relieve chokages on main line sewers, while the remaining 5 groups, having a total of 10 men and one foreman relieve house sewer chokages. In addition to the above force there are 2 men who are on duty on Sundays and holidays and also each day from 4 P. M. until midnight. They take care of any emergency that arises after working hours.

Cost of Sewer Maintenance.—The total cost of maintaining 1,560 miles of sanitary sewers and storm drains during 1927 was approximately $158,000. Of this amount $65,000 was spent on 1,000 miles of sewers and house connections at a cost of $65.50 per mile and $92,500 on 560 miles of drains at about $165 a mile.

Acknowledgment.—The foregoing is a paper presented at the 1928 meeting of the Maryland Water and Sewerage Association.

*The Roland Park system was built as a private system prior to Annexation. The city does not construct lateral sewers less than 8 inches in diameter.

New Water Rates at Washington, D. C.

In the fiscal year ended June 30, 1927, the rates for water in the District of Columbia were increased as follows:

The rates for domestic purposes are charged according to stories and front feet. On all tenements two stories high or less with front width of 16 ft. or less, $7.03 per annum, in advance. For each additional front foot or fraction thereof greater than one-half, 44 ct. For each additional story or part thereof, one-third of the charges as computed above.

Business premises are rated according to their size, class, volume of business, and water facilities, and rate from $1.41 to $25. If the flat rate on business establishments reaches $25 or more the owner or occupant is required to install a water meter at his own expense.

A minimum rate of $6.36 is charged against all consumers supplied with water through meters, which allows the use of 7,500 cu. ft. of water during the year; water used in excess is charged for at the rate of 6 ct. per 100 cu. ft. According to the report of J. S. Garland, Superintendent, Water Department, the average payment for metered premises (District meters only) was $7.68. The average payment on flat rate accounts was $9.65.

Build Hospital From Profits of Water Works and Light Plant

Water and Light Board Uses Funds for Work

THE Board of Public Works, of Holland, Mich., of which Roy B. Champion is superintendent, has just completed a very worthy project paid for out of the earnings of the municipally operated water works and electric light plant, the financing being done with idle corporate funds. This unusual venture in public work affords the city a new 50-bed modern hospital without extra cost to the taxpayers after two proposals in recent years to build a municipal hospital were rejected in elections. The project was started in October, 1925, when the Board passed a resolution and transmitted it to the Council, as follows:

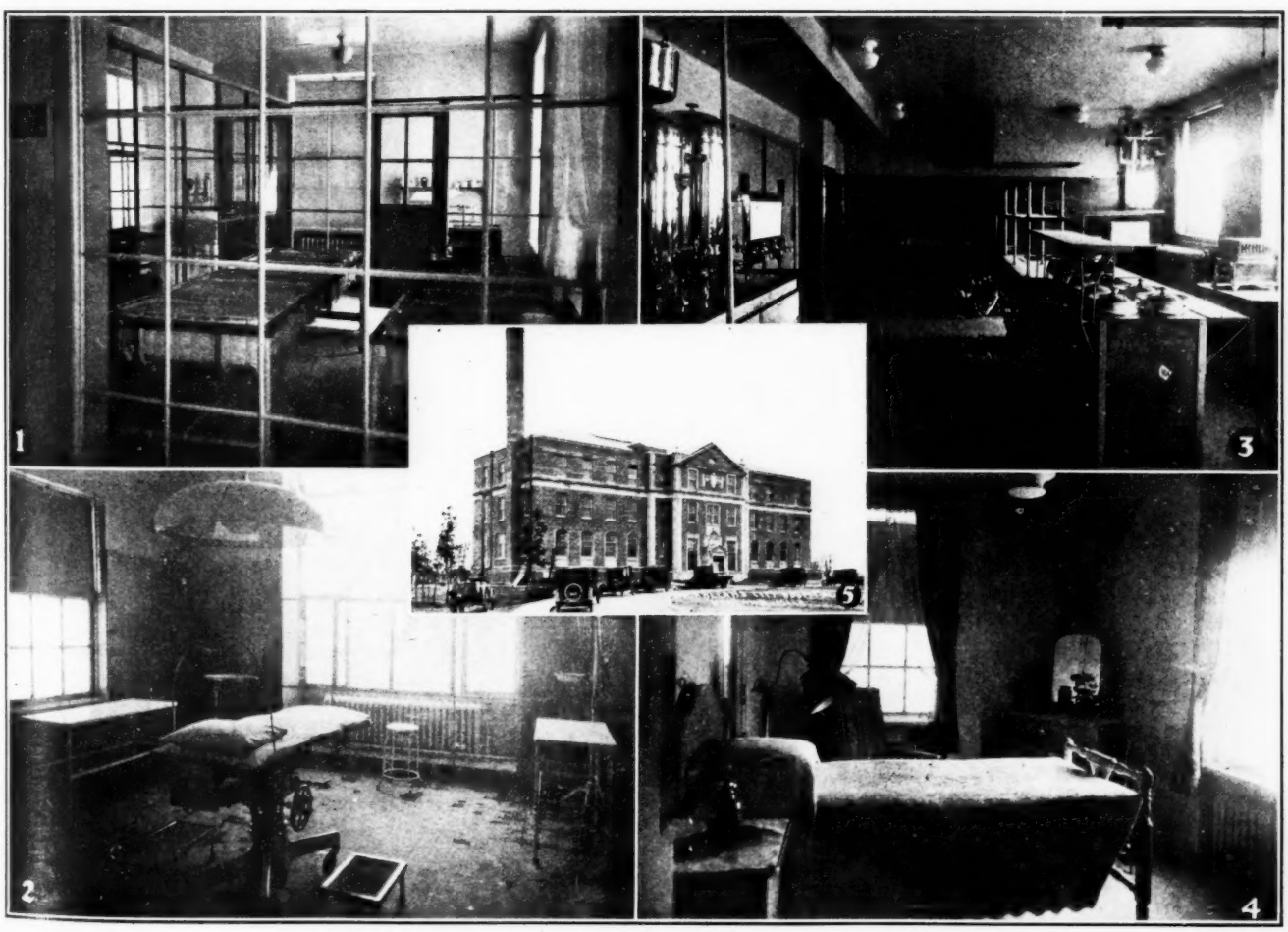
"Whereas, the Board of Public Works of the City of Holland has heretofore undertaken, as far as it could consistently do so, with due regard to the business and demands of the Board, to assume and pay the bonded indebtedness, with the interest thereon owing by the City of Holland; and

"Whereas, the Board feels that whenever possible new developments required by the City should be paid for on a current cost basis, rather than the further issuance of City bonds, as far as the same can reasonably be done; and

"Whereas, the Board is of the opinion that a City or Municipal Hospital is urgently needed in the City of Holland, and that it should be built and owned by the City rather than as a separate or private institution; and that if the City as a whole contributes to its construction, the sentimental effect at least will be much greater than if built by private subscription, even though it is later donated to the City; now therefore,

"Be It Resolved, by the Board of Public Works of the City of Holland, that the Board will undertake to finance the erection of a municipal hospital in and for the City of Holland, the details to be later determined upon by a joint committee as the Council may order and appoint, or by a committee agreed upon at a joint meeting of the Board of Public Works, Common Council, and the Hospital Board, said meeting to be called by the Common Council at such time as the Council may order and direct."

The upshot of this resolution was that the council approved the plan, a committee was appointed, and that in due course an architect was appointed, designs were prepared, and finally contracts were let. The architects who designed the hospital were Pond and Pond, Martin and Lloyd of Chicago, a prominent architectural firm whose work is known throughout the country. The building erected, and recently completed, is one of 265,500 cu. ft. capacity,



Exterior and Four Interior Views of the New Municipal Hospital at Holland, Mich., Financed Out of the Profits of the Water Works and Municipal Light Plant

of fireproof construction comprising a combination of reinforced concrete and steel structural frame and floors with brick walls and stone trim and modern interior construction, and is one of a future group of buildings to be developed as rapidly as feasible. One whole floor is devoted to operating and treatment facilities, and part of another, while the remainder of this three story building will be devoted to rooms and wards that will afford a total of 47 beds for patients. The cost of the structure, without equipment, and including architects' fees, was approximately $168,000, while the cost of the land was $7,000 and the cost of improvements to the land was another $8,000. The board did not defray the costs of equipping the building, which costs are necessarily high. The following tabulation gives the construction and other costs assumed by the Department:

General Contract, Extras	$112,880.00
Heating, Ventilating	14,494.50
Plumbing	14,842.58
Water Softener	1,918.00
Electric Wiring	6,773.00
Elevators	5,180.00
Hardware	1,454.00
Weather Stripping, Screens	2,248.00
Architects' Fee	9,084.40
Cost of Building	$168,874.48
Land	7,000.00
Improvements to Land	8,008.48
Grand Total	$183,882.96

Financially, the Board seems well on the way to pay up its indebtedness on this venture without being forced to sell securities now held by the Board that would be available for use in paying for the building. To date the sum of approximately $132,000 is still owed on the work, but due to special arrangements concerning the use of idle City funds and making payments out of the current earnings of the water works and the light plant, it is probable that the full amount will be paid easily without recourse to that sale of the above securities, which are bringing in interest at the rate of 5½ and 6 per cent. This expectation seems reasonable since the pumping stations and light plant are in good shape and no heavy expenditures are to be expected in the near future.

It is interesting to note here that the hospital is showing an operating deficit during first four months of the year of only about $1,500, or an indicated annual deficit of less than $5,000, or about one-half of the amount previously estimated.

It is also of interest to note that in 1927 the lighting plant had a net income of $129,217.14 after deducting operating expenses of $146,258.42 from the total operating revenue of $264,775.14 and adding a non-operating revenue of $10,700.42. This net income covers an output to 4,879 consumers at an average price per kw-hr. of 4.27 ct. and a profit per kw-hr. of 1.91 ct. Out of this profit, the light plant paid out $35,000 on the hospital during 1927.

Records of the water works show that during the same year the total pumpage was approximately 480 MG for the year, and that with a general water rate of 11 ct. per 100 cu. ft. for the first 50,000 cu. ft. and other rates in proportion, and serving an estimated population of 14,500, that the total operating revenue per capita was $4.81, the investment per capita was $28.25, and the net income was $25,685, or $6.27 per $100 invested. The total cost per 1,000 gal. pumped was 9.47 ct., the lowest cost since 1923. The average price received per 1,000 gal. pumped was 14.50 ct.

With such profitable operation of the pumping stations and the electric light plant, it is no wonder that the Board of Public Works has been able to give the taxpayers such a fine new hospital without calling for tax money or selling bonds to pay for the venture.

Cost of Operating the Municipal Asphalt Plant at Washington, D. C.

In the annual report of the operation of the engineering department of the District of Columbia for the fiscal year ended June 30, 1927, Mr. C. B. Hunt, Engineer of Highways, gives the following data on the operation of the municipal asphalt plant.

The total output of the plant for the year was 203,076 cu. ft. of material consisting of 5,568 cu. ft. of old material and 197,508 cu. ft. of topping mixture. The plant was operated for 255¾ days, with an average daily output of 794 cu. ft.

Constant attention is given to the maintenance of the plant, repairs being made and parts replaced when necessary, thereby keeping it in the best operating condition possible. This cost is incorporated in the total cost of output shown below.

The following material in amount and cost average set forth below were purchased for use in manufacturing the output during the year:

Limestone dust, 400 tons	$ 5.45
Sand, 8,020.5 cu. yd. (including haul)	1.32
Asphaltic cement, 1,101.8915 tons	21.65

There were purchased for use in operating the mixer the following large items and the cost average:

Fuel oil, 39,878 gal.	$ 0.06439
Coal, 320.01 tons	5.98
Wood, 50 cords	14.805

The cost of operation, including labor and material, are kept from day to day, and the summary of this data for the fiscal year develops the following unit costs for the year's operation:

Operation of Plant
(Period of operation, 255¾ days; total output, 203,076 cu. ft.)

	Per cu. ft. Cts.
Total manufacturing cost per cubic foot:	
Labor	8.70
Fuel Oil	1.30
Coal	.93
Wood	.18
Total cost	11.11
Haul from plant to street, labor	6.66
On street:	
Labor	30.55
Painting joints	.41
Fuel	.18
Total cost	31.14
Maintenance and repairs:	
At plant	.58
On street	.07
Total cost	.65

Overhead: The original cost was amortized by deducting 20 per cent from same each year during the first five years of its life.

Supervision: Foremen and overseers	5.79
Total manufacturing cost per cubic foot:	
Plant labor	11.11
Hot haul	6.66
Street work	31.14
Maintenance of plant and tools	.65
Supervision	5.79
Total cost	55.35

The sand used was bought under contract at 80 ct. per cubic yard and hauled from the wharf to the plant at the cost of $4,156.14 for 8,020.50 cu. yd., or $0.52 per cubic yard, a total of $1.32 per cubic yard. All other expendable material was delivered at the plant site at the cost thereof used herein.

Topping mixture:	
94.21 lb. of sand, at $0.80 per cu. yd.; hauled, $0.52 per cu. yd.	$0.05483
9.58 lb. limestone dust, at $5.45 per ton	.02610
11.05 lb. asphaltic cement, at $21.65 per ton	.11961
Cost of material	.20054
Manufacturing and placing cost	.55350
Total cost per cu. ft.	.75404

Mr. Hunt has kindly furnished us the following additional information regarding the organization and wages.

The plant operating force consists of one foreman at $7.70 per diem and the following:

1 steam engineer at plant	$ 5.92
1 steam engineer at plant	5.04
1 fireman at plant	*4.00
1 timekeeper	4.48
1 skilled laborer	4.00
12 unskilled laborers	3.68
1 watchman	3.00
5 trucks (owned by District)	†4.00
2 trucks, privately owned, each	10.80

The street placing force is as follows for each repair gang:

1 foreman, per annum	$1,680.00
2 rakers, per diem	4.08
3 tampers, per diem	4.08
3 shovellers, per diem	4.08
4 rollermen, per diem	4.08
4 laborers, per diem	3.08
1 2-ton truck, per diem	10.80
1 1½-ton truck, per diem	**4.00

*Acts as watchman in emergency.
†per diem pay of driver.
**Without driver.

Each gang places an average of about 288 cu. ft. per day. The number of street gangs varies with the seasonal and other controlling conditions up to the total capacity of the plant.

Cost of House Service Sewers at Washington, D. C.—During the fiscal year ended June 30, 1927, service sewers constructed in Washington, D. C. under contract and by day labor totaled 113,131 ft., costing $585,976 and serving 1,153 houses. These figures show the average length of sewers for each house served to be 98.2 ft. at an average cost of $508.66 per house.

Method of Rating Swimming Pools at Baltimore, Md.

Swimming Pool Score Card for Comparing Efficiency

IN the spring of 1926 the Division of Chemical Technology of the Bureau of Chemistry and Food of the City of Baltimore, Md., was instituted to make a survey of all swimming pools in the city and to offer assistance in an effort to correct any faulty and insanitary conditions that might exist. In order to stimulate interest on the part of those in charge of the various pools, a system of competition scoring was inaugurated. This system was described by Mr. M. H. Coblentz, Chief of the Division, in a paper presented at the 1928 meeting of the Maryland Water and Sewerage Association, from which the matter following is taken:

The forms of scoring and rating systems together with an explanation of the items follow:

Expanation of Items on Swmiming Pool Score Cards

The score card and system of rating will be used in rating the sanitary efficiency of your swimming pool. Constant attention to the many details involved in its safe operation will produce higher scores and greater healthfulness. The operator should keep daily records of the number of persons using the pool and other data required for use in scoring. Samples will be drawn from time to time by a Health Department representative for purposes of bacterial and chemical examination.

Equipment.—Walkways surrounding the pool should drain to properly located drains and should be always clean, and scum or overflow gutters shall permit of ready cleaning and flushing.

A plentiful supply of outdoor air and direct sunlight where possible should have access to indoor pools.

Dressing rooms should be well lighted and ventilated as well as commodious and clean. Floors should have good drainage and frequent cleaning. Persons not dressed for bathing should not be allowed on walks surrounding pool.

Before entering the pool all persons shall take a shower bath with soap, and entrance should be direct from the shower. Shower room drains should be adequate for quick removal of waste water. At least 1 shower should be provided for every 40 dressing rooms. Where possible foot pools with running water should precede the shower compartments.

Toilets should be conveniently located and there shall be at least one stool for every 40 rooms. Urinals should be ample and of a type to prevent splashing of urine on the floor, or on to the feet of bathers. Seats should be of sanitary construction and kept clean. The floor shall be of material impervious to water and easily cleaned.

The general layout should be so arranged that the line of travel from natatorium entrance to pool shall be progressive and with no retracing of steps.

Management. — Change of water should be adequate, and the water should be frequently freed from scum. Disinfection whether continuous or between use should be adequate, i.e., there should be an excess of the disinfectant at all times. The representative of the Health Department will be glad to furnish chlorine testing equipment and advice concerning control of disinfection, etc.

All bathing suits and towels should be steam washed with soap after each use. If chemically disinfected this should follow the steam washing and precede rinsing. Only non-colored or fast-color suits should be used. No common combs or brushes should be accessible in dressing rooms or pool areaways.

To prevent spread of communicable diseases, no persons with eruptions or bandages, nor persons suffering from fever cold, cough or inflamed eyes should be allowed to use the pool, and spitting in, or in any other way contaminating the pool, floors, runways, aisles or dressing rooms should be prohibited.

Bather control should be rigidly enforced. Every person should bathe

Name ..... Supt. .....
No. of bathers last week..... No. of gallons water added last week.....
Date of last emptying and scoring.....
Disinfectants used..... Date of last check up.....

Equipment	Score
POOL STRUCTURE—20	
Walls, waterproof and smooth	4
Floors, waterproof and smooth	4
Curbing, 2 in. high	4
Curbing, 1 in. high	2
Walkways, sanitary, cleanable	4
Scum gutters	4
VENTILATION—10	10
LIGHT—15	
Direct sunlight from all sides	15
DRESSING ROOMS—5	
Light and ventilation	2
Cleanableness	2
Restriction to bathers	1
SHOWERS AND BATHS—30	
Automatic shower	10
Automatic foot-bath	10
Soap	10
TOILETS—15	
Adequacy (1 to 40 rooms)	3
Sanitation (absence of splash on feet)	4
Flushing (automatic or continuous)	2
Seats (sanitary construction)	6
LAYOUT—5	5
	100

Management	Score
WATER—35	
Changed weekly	10
Freedom from scum	5
Disinfection, continuous	10
Between use	10
LAUNDERING—6	
Towels suits, etc. soap washed	3
Disinfected	3
COMMUNICABLE DISEASE PRECAUTIONS—15	
(Persons with eruptions, bandages, etc.	15
BATHER CONTROL—20	
Bathing before entering	10
Limitation to 1 hr.	5
Limitation to 20 persons per 1,000 gals. of entering water during period	5
POSTERS—4	
Cards about pool at least, 10x12	2
Cards in dressing rooms	1
Notices prominently displayed	1
RECORDS—20	
Number of bathers	4
Vol. new water added	4
Temp. of water	1
Temp. of air	1
Water treatment data	5
Cleaning data	3
Chemical data	2
	100

SYSTEM OF RATING

	Score
Equipment (score)	100
Management (score x2)	200
Condition of water (data of Health Department)	200
Bacterial control—100	
Counts	50
Not over 10 per cent of samples over 2000 per c.c. at 20 deg.	25
Not over 10 per cent of samples over 500 c.c. per c.c. at 37 deg.	25
Index—50	
Not over 2 out of 5 samples positive for confirmed B. coli on same day	25
Not over 3 out of 10 samples positive for confirmed B. coli on consecutive days	25
Chemical control—100	
Chlorine—90	
Over 0.2 p.p.m.	90
0.15—0.2 p.p.m.	80
0.1—0.15 p.p.m.	50
0.05—0.1 p.p.m.	20
Acidity—10	
Alkaline reaction	10
Neutral	5
Acid	0
Score	500
Rating (Score divided by 5)	100

with soap before being allowed to enter the pool. No person should stay in the pool more than 1 hour.

A limit of 20 persons per 1,000 gal. of entering water during any period will be considered a proper bathing load. Entering water shall mean new clean water used to replace loss by splashing or during cleaning, and water taken from the pool and returned after effective filtration, or any combination of such water.

Notices and posters should be at least 10 in. x 12 in. and should be placed in conspicuous places throughout the natatorium.

Accurate records should be kept of the number of bathers per day, volume of new water added, and the temperature of water and air. Water treatment and cleaning data should be recorded regularly, and where chlorine, hypochlorite or other chlorine compounds are used, records of frequent tests by the operator should be kept. Excess chlorine should not be less than 0.2 nor more than 0.5 p.p.m.

The temperature of the water of artificially heated pools should not be above 72 deg. F nor under 60 deg. F. and the air temperature should be about 5 deg. F. warmer than the pool temperature, but not over 8 deg. F. warmer nor 2 deg. F. colder than the pool water. Where alum or sulphate of aluminum is used or where artificial alkalinity is added to the water, tests for acidity and alkalinity should be made every day that the pool is used.

Cost of Feeding Street Department Horses at Toronto, Ont.

The Street Cleaning Department of Toronto, Ont., maintains 384 horses. The average cost per day per horse for fodder in 1927 was 54.8 ct., according to the annual report of George W. Dies, Street Commissioner of Toronto.

The average daily rations per horse, based upon the consumption during the year, amounted to 13.2 lb. of oats, 35 lb. of hay, and 4 lb. of bran, while in addition 0.1 lb. of other feed was given, consisting principally of salt, vegetables, etc. Each horse was also bedded with 4 lb. of straw daily, while the specific rational allotment is 15 lb. of oats, and 25 lb. of hay per horse per day. This amount in many cases varied according to the temperament of the horse. On Sundays and holidays, or in the event of horses standing in the stable, only light feeding of oats is given.

The purchase of fodder supplies is an important item. Every care is exercised to ascertain that all feed is of governmental standard and free from moisture, dust, or rust.

The following is the detailed cost of fodder consumption per horse per day in 1927:

				Cost per Horse per day
Oats	13.2 lb.	at $ 0.632	per bu.	$0.246
Hay	35.9 lb.	at 14.95	per ton	0.268
Straw	4.7 lb.	at 10.96	per ton	0.026
Bran	.4 lb.	at 34.18	per ton	0.009
Salt	.05 lb.	at 22.50	per ton	
Carrots	.05 lb.	at 12.00	per ton	
Daily average, horses				380
Total horse days				138,871
Cost per horse per day				$0.548

Chart for Determining Chlorine Dose

A nomograph for determining the chlorine dose applied to a liquid that offers a rapid and accurate means of making such determination by a very simple operation is shown in the April Bulletin of the Maryland State Department of Health. Its utility may best be indicated by reviewing the example shown:

1,000,000 gal. of liquid treated with 8.33 lb. of chlorine; the resulting dose is read on the middle scale as 1 p.p.m. (if using liquid chlorine) and ⅓ p.p.m. (if using commercial hypochlorite of lime).

The chart was prepared primarily for use by the engineers of the Bureau of Sanitary Engineering of the Maryland State Department of Health for making determinations in the office and field. Later, it was decided to distribute copies to plant operators throughout the state so that they would have a time-saving, simple and accurate means of checking the operation of their plants.

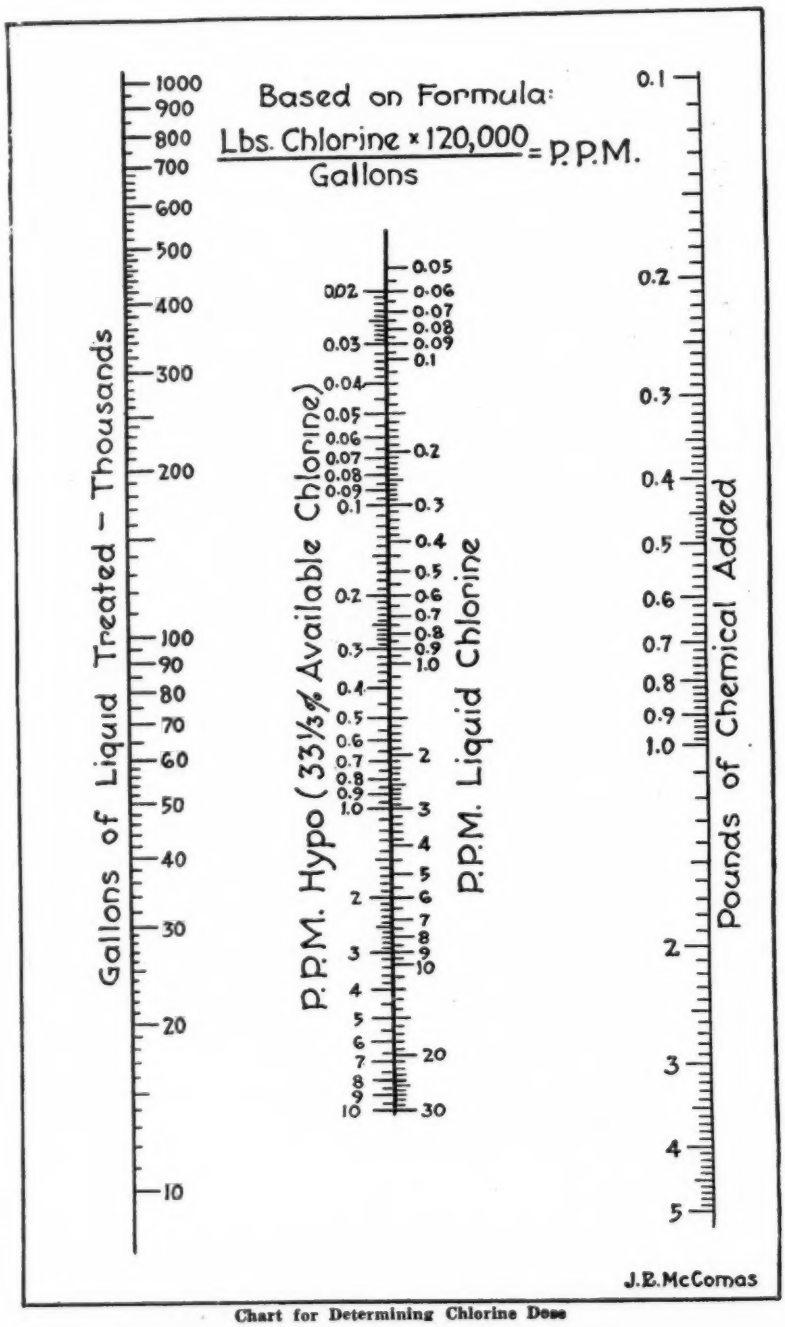

Based on Formula:
Lbs. Chlorine × 120,000 / Gallons = P.P.M.
Gallons of Liquid Treated – Thousands
P.P.M. Hypo (33⅓% Available Chlorine)
P.P.M. Liquid Chlorine
Pounds of Chemical Added
J.B. McComas

Chart for Determining Chlorine Dose

Tentative Draft of a Model Municipal Traffic Ordinance

Report of Hoover Committee Made Public on May 1

IN response to requests from a number of the organizations participating in the National Conference on Street and Highway Safety that a model municipal traffic ordinance be drawn up, Secretary of Commerce Hoover in the summer of 1927 appointed a committee to report on the subject.

The committee carried on preliminary work during the summer and fall, including an analysis of the traffic ordinance of 100 American cities together with the model ordinances existing in several states and a study of the subject matter appropriate for an ordinance adaptable to the needs of municipalities throughout the country. At a meeting in Washington, Dec. 7-10th the committee developed this material into a preliminary draft. This was further revised by the committee and put into tentative form for distribution to all interested for criticism and comment. This tentative draft of the model municipal traffic ordinance was given out on May 1. We are reprinting it below:

MODEL MUNICIPAL TRAFFIC ORDINANCE

An ordinance regulating traffic upon the public streets of the (City) or ( ) and repealing Ordinance (No.) and all other ordinances and sections of Ordinances in conflict herewith.

It is ordained by ( ) as follows:

ARTICLE I
DEFINITIONS

Section 1

Whenever in this Ordinance the following terms are used, they shall have the meanings respectively ascribed to them in this section.

Street or Highway. Every way set apart for public travel, except foot paths.

Private Road or Driveway. Every road or driveway not open to the use of the public for purposes of vehicular travel.

Roadway. That portion of a street or highway between the regularly established curb lines or that part devoted to vehicular traffic.

Sidewalk. That portion of a street between the curb lines and the adjacent property lines.

Intersection. The area embraced within the prolongation of the lateral curb lines or, if none, then the lateral boundary lines of two or more streets or highways which join one another at an angle whether or not one such street or highway crosses the other.

Crosswalk. That portion of a roadway ordinarily included within the prolongation of curb and property lines at intersections, or any other portion of a roadway clearly indicated for pedestrian crossing by lines or other markings on the surface.

Safety Zone. The area or space officially set apart within a roadway for the exclusive use of pedestrians and which is so marked or indicated by proper signs as to be plainly visible at all times while set apart as a safety zone.

Vehicle. Every device in, upon or by which any person or property is or may be transported or drawn upon a public highway, excepting devices moved by human power or used exclusively upon stationary rails or tracks.

Motor Vehicle. Every vehicle, as herein defined, which is self propelled.

Street Car. Every device traveling exclusively upon rails when upon or crossing a street, other than cars or trains propelled or moved by steam.

Authorized Emergency Vehicle. Vehicles of the Fire Department, (Fire Patrol), police vehicles and such ambulances and emergency vehicles of municipal departments or public service corporations as are designated or authorized by the (Chief of Police).

Pedestrian. Any person afoot.

Operator. Any person who is in actual physical control of a vehicle.

Traffic. Pedestrians, ridden animals, herded animals, vehicles and street cars either singly or together while using any street for purposes of travel.

Right-of-Way. The privilege of the immediate use of the street or highway.

Parking. The stopping or standing of a vehicle, whether attended or unattended, upon a roadway, otherwise than temporarily for the purpose of and while actually engaged in loading or unloading, or in obedience to traffic regulations or traffic signs or signals.

Official Traffic Signs. All signs and markings, other than signals, not inconsistent with this Ordinance, placed or erected by authority of a public body or official having jurisdiction, for the purpose of guiding, directing, warning or regulating traffic.

Official Traffic Signals. All signals, not inconsistent with this Ordinance, placed or erected by authority of a public body or official having jurisdiction, for the purpose of directing, warning or regulating traffic.

Traffic Control Signal. Any device using colored lights, or words, or any combination thereof, whether manually, electrically or mechanically operated, by which traffic is alternately directed to stop and to proceed.

Business District. The territory contiguous to and inclusive of a street or highway when 50 per cent or more of the frontage thereon for a distance of 300 ft. or more is occupied by buildings in use for business or industry.

Residence District. The territory contiguous to and inclusive of a street or highway not comprising a business district, when the lots with a frontage on such street or highway for a distance of 300 feet or more are mainly occupied by dwellings or by dwellings and buildings in use for business.

Police Officer. Every officer of the Municipal Police Department or any officer authorized to direct or regulate traffic or to make arrests for violations of traffic regulations.

Notes to Article 1—Definitions. The term **street or highway** is defined in as few words as possible and to embrace every street area in its entirety, including sidewalks. Requirements of law in some states may necessitate a further elaboration with specific reference to particular types of public ways, such as bridges, viaducts, vehicular tunnels, boulevards, avenues and other descriptive terms. However, in most states such enumeration is unnecessary, as all the various types of roads are held to be covered by the phrase, "Every way set apart for public travel."

ARTICLE II
AUTHORITY OF POLICE

Section 2. **Police to Direct Traffic.**

It shall be the duty of the Police Department of this city to enforce the provisions of this Ordinance. Officers of the Police Department are hereby authorized to direct all traffic either in person or by means of visible or audible signal in conformance with the provisions of this Ordinance, provided that in the event of a fire or other emergency or to expedite traffic or safeguard pedestrians, officers of the Police or Fire Department may direct traffic, as conditions may require, notwithstanding the provisions of this Ordinance.

Section 3. **(Board of Police Commissioners) Authorized to Adopt Emergency Regulations.**

The (Board of Police Commissioners) is hereby empowered to make and enforce regulations necessary to make effective the provisions of this Ordinance and to make temporary regulations to cover emergencies or special conditions, provided any such regulations are not inconsistent with the provisions of this Ordinance.

Note to Section 3. If desired a provision might be included in this section authorizing the police commission or other proper board or body to make and enforce additional regulations.

Section 4. **Obedience to Police.**

It shall be unlawful for any person to refuse to fail to comply with any lawful order, signal or direction of a police officer.

Section 5. **Public Employees to Obey Traffic Regulations.**

(a) The provisions of this Ordinance shall apply to the operator of any vehicle owned by or used in the service of the U. S. Government, this State, County or (City) and it shall be unlawful for any said operator to violate any of the provisions of this Ordinance, except as otherwise permitted in this ordinance.

(b) The provisions of this Ordinance regulating the movement, parking and standing of vehicles shall not apply to authorized emergency vehicles as defined in this Ordinance while the driver of such vehicle is operating the same in an emergency in the necessary performance of public duties. This exemption shall not, however, protect the driver of any such vehicle from the consequence of a reckless disregard of the safety of others.

Section 6. **Persons Propelling Push Carts or Riding Bicycles or Animals to Obey Traffic Regulations.**

Every person propelling any push cart or riding a bicycle or an animal upon a roadway, and every person driving any animal, shall be subject to the provisions of this ordinance applicable to the operator of any vehicle, except those provisions of this Ordinance with reference to the equipment of vehicles and except those provisions which by their very nature can have no application.

ARTICLE III
TRAFFIC SIGNS AND SIGNALS

Section 7. **Traffic Signs and Signals.**

(a) The (municipal legislative body) shall by resolution determine and designate the character or type of all official traffic signs and signals.

Subject to this selection, the (traffic authority) is hereby authorized, and as to those signs and signals required hereunder, it shall be the duty, to place and maintain or cause to be placed and maintained all official traffic signs and signals. All signs and signals required hereunder for a particular purpose shall so far as practicable be uniform throughout the (City).

(b) No provision of this Ordinance for which signs are required shall be enforceable against an alleged violator, if, at the time and place of the alleged violation the sign herein required is not in proper position and sufficiently legible to be seen by an ordinarily observant person.

Note to Section 7. In this and subsequent sections the term (traffic authority) is used merely as indicating that a city upon adopting the Ordinance should insert the designation of the appropriate city officer, board or department such as the chief of police, traffic engineer, superintendent of streets, etc., whose duty it shall be to carry out the provisions of the particular section. Also, in view of the fact that certain states apply a more strict rule than others with reference to the delegation of powers to administrative officers or boards, it may be necessary in certain instances to insert in place of (traffic authority) the correct designation of the legislative body of the city.

Section 8. **Obedience to Traffic Signs and Signals.**

It shall be unlawful for any operator or for the motorman of any street car to disobey the instructions of any official traffic sign or signal upon the street placed in accordance with the provisions of this Ordinance, unless otherwise directed by a police officer.

Section 9. **Traffic Control Signal Legend.**

Whenever traffic at an intersection is alternately directed to stop and to proceed by the use of signals exhibiting the words "Stop," "Go" or "Caution" (or "Wait") or exhibiting colored lights, said terms and lights shall indicate as follows and no colored lights other than those specified herein shall be used.

(a) When the word "Stop" or the color red is exhibited after green, no waiting vehicle facing the signal shall proceed until the green or "Go" signal is displayed alone, and every moving vehicle facing the signal shall stop on the near side of the crosswalk (or the nearest property line of the cross street), unless at the time the word "Stop" or the color red is first displayed the moving vehicle is less than the normal braking distance from the crosswalk (or nearest property line of the cross street), in which event it may proceed. When the word "Stop" or the color red is exhibited after yellow or amber, no vehicle facing the signal shall enter the intersection until the green or "Go" signal is displayed alone.

(b) When the word "Go" or the color green is exhibited alone, traffic facing the signal may proceed, except that such traffic shall yield the right of way to pedestrians and vehicles lawfully within a crosswalk or the intersection at the time such signal was exhibited.

(c) When the word "Caution" or "Wait" or the color yellow or amber is exhibited following or with green, no waiting vehicle facing the signal shall proceed, and every moving vehicle facing the signal shall stop if possible as provided in subsection (a) of this section. When such word or color is exhibited following or with red, no vehicle facing the signal shall enter the intersection until the green or "Go" signal is displayed alone.

Note to Section 9. In the event of special conditions rendering it advisable to permit right or left turns by traffic facing a red or "Stop" signal, it is suggested that an additional subsection be added to Section 9 to read as follows:

(d) A special signal light in the form of an arrow showing green may be employed to permit turning movement in the direction of the arrow at times when such movement would otherwise be prohibited according to the traffic control signal legend set forth in this section.

Section 10. **Display of Unauthorized Signs and Signals Prohibited.**

It shall be unlawful for any person to place or maintain or to display upon or in view of any street any unofficial sign, signal or device which purports to be or is an imitation of or resembles an official traffic sign or signal, or which attempts to direct the movement of traffic. Every such prohibited sign, signal or device is hereby declared to be a public nuisance, and the (Chief of Police) is hereby empowered to remove the same, or cause it to be removed, without notice.

Section 11. **Interference with Signs and Signals Prohibited.**

It shall be unlawful for any person to wilfully deface, injure, move, obstruct or interfere with any official traffic sign or signal.

Section 12. **(Traffic Authority) Authorized to Designate Crosswalks.**

The (traffic authority) is hereby authorized to establish and to designate and shall thereafter maintain, by appropriate devices, marks or lines upon the surface of the roadway, crosswalks approximately equal in width to the adjacent sidewalk at all intersections where in his opinion there is particular danger to pedestrians crossing the roadway.

Section 13. **(Traffic Authority) Authorized to Designate Safety Zones and Lanes for Traffic.**

(a) The (traffic authority) is hereby empowered to establish safety zones of such kind and character and at such places as he may deem necessary for the protection of pedestrians.

(b) The (traffic authority) is also authorized to mark lanes for traffic on street pavements at such places as he may deem advisable, consistent with the provisions of this Ordinance.

Note to Sections 12 and 13. If it is desired that the designated officer shall also determine and designate those intersections at which left turns shall not be made an additional subdivision might be added to Section 13 to read as follows:

(c) The (traffic authority) is hereby empowered to determine those intersections at which operators of vehicles shall not make a left turn and shall place proper signs at such intersections.

If the Ordinance itself is to designate the intersections at which no left turns shall be made then an additional section should be inserted following Section 38, to read as follows:

Section 38½. Left Turns Prohibited. The operator of a vehicle shall not (between the hours of 7 A. M. and 7 P. M. of any day except Sunday or a legal holiday) make a left turn at any of the following intersections:.....

.....

.....

Signs shall be erected and maintained designating the provisions of this section.

Additional Note: In special cases where pedestrian movement is very heavy or other conditions require it, it may be advisable to eliminate right turns or all turns. This can be treated by the same alternative methods suggested above.

ARTICLE IV
PEDESTRIANS' RIGHTS AND DUTIES

Section 14. **Pedestrians' Right of Way.**

(a) The operator of any vehicle shall yield the right of way to a pedestrian crossing the roadway within any marked crosswalk or within any unmarked crosswalk at the end of a block, except at intersections where the movement of traffic is being regulated by police officers or traffic control signals.

(b) When a pedestrian crossing or about to cross a roadway and having the right of way as above provided indicates his intention to proceed by holding up his hand palm out toward approaching traffic, no operator of a vehicle more than the normal braking distance from such pedestrian shall fail to grant the right of way to said pedestrian; provided, however, that failure of a pedestrian so to hold up his hand shall in no way relieve the driver of a vehicle from the provisions of paragraph (a) above.

(c) Whenever any vehicle has stopped at a marked crosswalk or at any intersection to permit a pedestrian to cross the roadway, it shall be unlawful for the operator of any other vehicle approaching from the rear to overtake and pass such stopped vehicle.

(d) Every pedestrian crossing a roadway at any point other than within a marked or unmarked crosswalk shall yield the right of way to vehicles upon the roadway, provided that this provision shall not relieve the driver of a vehicle from the duty to exercise due care for the safety of pedestrians.

Section 15. **Pedestrians' Rights and Duties at Controlled Intersections.**

At intersections where traffic is controlled by traffic control signals or by police officers, pedestrians shall yield the right of way to vehicles lawfully proceeding directly ahead on a "Go" signal as authorized in Section 9, and operators of vehicles shall yield the right of way to pedestrians crossing or those who have started to cross the roadway on a "Go" signal.

Note to Section 15. In those municipalities where it is believed that pedestrian obedience to traffic control signals should be definitely required, the following wording for Section 15 is suggested:

Alternate Section 15. Pedestrians' Rights and Duties at Controlled Intersections.

On streets where traffic at intersections is controlled by traffic control signals or by police officers pedestrians shall not cross a roadway against a red or "Stop" signal, and shall not cross at any place except in a marked or unmarked crosswalk. A pedestrian crossing or starting across in any such crosswalk on a green or "Go" signal shall have the right of way over all vehicles, including those making turns, until such pedestrian has reached the opposite curb or a safety zone, and it shall be unlawful for the operator of any vehicle to fail to yield the right of way to any such pedestrian.

Note—The success of a rule requiring definite obedience to traffic control signals by pedestrians depends in large measure upon a proper timing of the signals, and also intensive educational activities. This point is discussed in the report accompanying this model ordinance.

Section 16. **Pedestrians to Use Right Half of Crosswalk.**

Pedestrians shall move, whenever practicable, upon the right half of crosswalks.

Section 17. **Pedestrians Soliciting Rides.**

It shall be unlawful for any person to stand in a roadway for the purpose of soliciting a ride from the operator of any private vehicle.

ARTICLE V
STREET CARS AND RAILROAD TRAINS

Section 18. **Pasing Street Cars.**

(a) The driver of a vehicle shall not overtake and pass upon the left any interurban or street car proceeding in the same direction, whether actually in motion or temporarily at rest, when a travelable portion of the highway exists to the right of such street car.

(b) The driver of a vehicle overtaking any railway, interurban or street car stopped or about to stop for the purpose of receiving or discharging any passenger, shall bring such vehicle to a full stop at least 10 ft. in the rear of such street car and remain stationary until any such passenger has boarded such car or reached the adjacent sidewalk, except that where a safety zone has been established, or at an intersection where traffic is controlled by an officer or traffic stop-and-go signal, a vehicle need not be brought to a full stop before passing any such railway, interurban or street car, but may proceed past such car at a speed not greater than is reasonable or proper and in no event greater than 10 miles an hour and with due caution for the safety of pedestrians.

Note to Section 18. The text appearing above is taken verbatim from the Uniform Vehicle Code approved by the National Conference on Street and Highway Safety. The Committee on Municipal Traffic Ordinances and Regulations recommends that the Uniform Vehicle Code be amended to incorporate, and that the Model Municipal Traffic Ordinance incorporate, a revised section on passing street cars to read as follows:

Revised Section 18. **Passing Street Cars.**

(a) The operator of a vehicle shall not overtake and pass upon the left any street car proceeding in the same direction, whether actually in motion or temporarily at rest, when a traversable portion of the highway exists to the right of such street car, even though such portion of the highway is occupied by traffic. This provision shall not apply on one-way streets.

(b) The operator of a vehicle overtaking any street car stopped or about to stop for the purpose of receiving or discharging any passenger, shall stop such vehicle to the rear of the nearest running board or door of such street car and keep it stationary until any such passenger has boarded such car or reached a place of safety, except that where a safety zone has been established, a vehicle need not be stopped before passing any such street car, but may proceed past such car at a speed not greater than is reasonable or proper, and with due caution for the safety of pedestrians.

Note to Revised Section 18. In streets where the street car track or tracks are located elsewhere than in or near the center of the roadway, or where because of unbalanced vehicle traffic or for any other reason it becomes desirable to establish lanes of traffic on the left of street cars, an exception to paragraph (a) above can be made. Such streets will probably not be numerous and the permanent location of the car tracks will definitely govern the conditions, so that they can be named in a new paragraph (b), which will also embody the last sentence of paragraph (a), as follows:

(b) The provision in subsection (a) shall not apply on one-way streets, or on the following streets between the points named:

.....

.....

Section 19. **Driving on Street Car Tracks.**

(a) It shall be unlawful for the operator of any vehicle proceeding upon any street car tracks in front of a street car upon a public street, to fail to remove such vehicle from the tracks as soon as practicable after signal from the operator of said street car.

(b) When a street car has started to cross an intersection, no operator shall drive upon the car tracks within the intersection in front of the street car.

Section 20. **Driving Through Safety Zone Prohibited.**

It shall be unlawful for the operator of a vehicle at any time to drive the same over or

through a safety zone as defined in this ordinance.

Note to Section 20. In the event a municipality desires to prohibit driving to the left of a safety zone, a provision as follows should be added to Section 20:

(b) It shall be unlawful for the operator of a vehicle at any time to drive the same to the left of a safety zone.

Section 21. **Boarding or Alighting from Street Cars or Vehicles.**

It shall be unlawful for any person to board or alight from any street car or vehicle while such street car or vehicle is in motion.

Section 22. **Unlawful Riding.**

It shall be unlawful for any person to ride on any street car or vehicle upon any portion thereof not designed or intended for the use of passengers when the vehicle is in motion. This provision shall not apply to an employee engaged in the necessary discharge of a duty, or within truck bodies in space intended for merchandise.

Section 23. **Railway Trains and Street Cars Not to Block Street.**

It shall be unlawful for the directing officer or the operator of any steam or street railway train or car to direct the operation of or to operate the same in such a manner as to prevent the use of any street for purposes of travel for a period of time longer than five minutes, except that this provision shall not apply to trains or cars in continuous motion. It shall be unlawful for any street railway train or car to stop within an intersection or on a crosswalk for the purpose of receiving or discharging passengers.

ARTICLE VI
STOPPING, STANDING AND PARKING

Section 24. **Stopping Prohibited in Specified Places.**

It shall be unlawful for the operator of a vehicle to stop, stand or park such vehicle in any of the following places, except when necessary to avoid conflict with other traffic or in compliance with the directions of a police officer or traffic control sign or signal:

(1) Within an intersection.

(2) On a crosswalk.

(3) Between a safety zone and the adjacent curb or within twenty (20) ft. of a point on the curb immediately opposite the end of a safety zone, unless the (traffic authority) shall indicate a different length by signs.

Note: It is recommended that in no event should vehicles be stopped or parked within fifteen (15) ft. of the end of a safety zone. The exact distance to be specified might depend upon the width of the roadway, volume of traffic and other material factors.

(4) Upon the approach to an intersection, within fifteen (15) ft. of the inside boundary line of the sidewalk, or, if no sidewalk is in place, within twenty-five (25) feet of the intersecting roadway, except that this provision shall not apply at alleys.

(5) Within fifteen (15) ft. of the driveway entrance to any fire station, or directly across the street from such entrance.

(6) Within fifteen (15) ft. of a fire hydrant.

(7) In front of a private driveway.

(8) On a sidewalk.

(9) Alongside or opposite any street excavation or obstruction when such stopping, standing or parking would obstruct traffic.

Note to Section 24. This Section and Section 33 are designed to prohibit double line stopping or parking and specifically prohibit stops even temporarily for any purpose in those places enumerated in Section 24 except as noted therein.

It has been pointed out that such regulations, coupled with the fact that remaining curb space may be fully occupied by parked vehicles, would render it impossible for a bus, taxicab or private vehicle to pull alongside the curb or to stop even temporarily in the second line of traffic or in any of the prohibited spaces to load or unload passengers. In other words, there might be no place legally available for a temporary stop.

While stopping even temporarily in most of the places enumerated causes interference with moving traffic and may well be prohibited as declared in the text, and while ample passenger zones, as distinguished from loading zones, designated as provided in Section 25 to permit buses, taxicabs and private vehicles to load and unload passengers at the curb, may meet the situation, an additional method has been suggested that Subdivisions (6) and (7) be omitted from Section 24 and placed in a separate section providing that stopping or parking in such places shall be prohibited, except temporarily for the purpose of, and while actually engaged in, loading or unloading passengers. Such a section might read as follows:

Section 24½. **Stopping Temporarily to Load or Unload Passengers.**

It shall be unlawful for the operator of a vehicle to stop or park such vehicle in any of the following places except temporarily for the purpose of and while actually engaged in loading or unloading passengers, and in no case shall such vehicle be left even momentarily unattended:

(1) Within fifteen (15) ft. of a fire hydrant.

(2) In front of a private driveway.

Section 25. **Standing for Loading or Unloading Only in Certain Places.**

(a) It shall be unlawful for the operator of a vehicle to stop, stand or park said vehicle for a period of time longer than is necessary for the actual loading or unloading of passengers in any place marked as a passenger zone.

(Note to subsection (a).) Passenger zones are required for the convenience of passenger traffic at places of public gatherings such as the entrances to schools, churches, theatres, hotels, hospitals and so forth. They should be clearly marked as to their extent and the hours when the regulation is applicable, and during those hours should be used exclusively for passenger loading and unloading.

(b) It shall be unlawful for the operator of a vehicle to stop, stand, or park said vehicle for a period of time longer than is necessary for the actual loading or unloading of passengers, or for the unloading and delivery or pick up and loading of materials, in any place marked as a loading zone.

(Note to subsection (b.) Loading zones are requisite to reduce double-line parking in congested districts, through the provision of suitable spaces along the curbs for loading and unloading operations. Loading zones should be placed as required before the shipping entrances to buildings, and at other places where there is a large volume of commercial traffic. Where necessary the regulation should be applied to the lengths of alleys or other ways where the parking interferes with the loading and unloading of mechandise. Since passenger loading or unloading is of short duration it may be permitted in such zones without undue interference to commercial traffic.

It may be desirable to permit unrestricted parking in loading zones during evening hours, in which event there should be added to paragraph (b) the sentence: "The provisions of this subsection (b) shall not be applicable between the hours of 6:00 P. M. and 6:00 A. M."

(c) The (traffic authority) shall have authority to determine the location of passenger zones and loading zones as described herein, and shall erect and maintain appropriate signs indicating the same.

Note to subsection (c). A municipality may desire to specify more definitely in subsection (c) the limitations to govern the (traffic authority) in locating passenger zones and loading zones. In some ordinances it is provided that loading zones shall not exceed a stated percentage of the curb lines in any block.

Section 26. **(Traffic Authority) Authorized to Designate Bus Stop, Taxicab Stands and Hackney Stands.**

The (traffic authority) is hereby authorized and required to establish bus stops, taxicab stands and hackney stands on public streets in such places and in such number as he shall determine to be of the greatest benefit and convenience to the public, and shall appropriately sign every such bus stop, taxicab stand or hackney stand.

Note to Section 26. A municipality may desire to specify in more or less detail in the ordinance the places where the bus stops, taxicab stands, and hackney stands may be located by the (traffic authority).

Section 27. **Other Vehicles Prohibited from Parking in Bus Stops, Taxicab Stands or Hackney Stands.**

It shall be unlawful for the operator of any vehicle other than a bus to stand or park in an officially designated bus stop, or for any vehicle other than a taxicab to stand or park in an officially designated taxicab stand, or for any vehicle other than a hackney to stand or park in an officially designated hackney stand, except that the operator of any passenger vehicle may temporarily stop in any such stop or stand for the purpose of and while actually engaged in the loading or unloading of passengers.

Section 28. **Buses, Taxicabs and Hackneys Prohibited from Parking Except in Designated Stands.**

It shall be unlawful for the operator of any bus, taxicab or hackney to stand or park upon any street in any business district at any place other than at a bus stop, taxicab stand or hackney stand respectively, except that this provision shall not prevent the operator of any such vehicle from temporarily stopping in accordance with other parking regulations at any place for the purpose of and while actually engaged in loading or unloading passengers.

Note to Sections 26, 27 and 28. The designations of bus stops is for the primary purpose of providing spaces where buses can receive and discharge passengers without impeding traffic. The designation of taxicab stands and hackney stands serves the same purpose with respect to taxicabs and hackneys and the additional important purpose of removing the incentive to cruising. A municipality may not desire, however, to differentiate between bus stops, taxicab and hackney stands, in which event Sections 26, 27 and 28 can be simplified to provide for the designation of stands for public vehicles, to prohibit other than public vehicles from parking in those stands, and to prohibit public vehicles from parking elsewhere.

Section 29. **Parking Prohibited in Certain Places.**

It shall be unlawful for any operator to stop, stand or park any vehicle in such a manner or under such conditions as to leave available less than 10 ft. of the width of the roadway for the free movement of vehicular traffic, except that this provision shall not apply to the operator of a vehicle stopped momentarily during the actual loading or unloading of passengers if such stopping does not actually impede traffic, nor shall it apply to a necessary stop in obedience to traffic regulations or traffic signs or signals or a police officer.

Section 30. **Parking Time Limited in Designated Places.**

The operator of a vehicle shall not park such vehicle for longer than.....at any time, between the hours of.....A. M. and.....P. M. of any day except Sundays and public holidays in the following described district:

.....

.....

Signs shall be erected and maintained in each block designating the provisions of this section.

Note to Section 30. This section is appropriate where it is desired to limit parking in any designated district to a certain maximum length of time between specified hours.

Section 31. **Parking Prohibited During Certain Hours in Designated Places.**

The operator of a vehicle shall not park such vehicle between the hours of.....of any day except Sundays and public holidays within the (designated district) or upon any of the following described streets:

.....

.....

Signs shall be erected and maintained in each block designating the provisions of this section.

Note to Section 31. This section is appropriate where it is desired to prohibit parking in the central business district or on certain streets during the entire business day or during the morning or evening rush hours, or at other times to be specified in the section.

Section 32. **Early Morning Parking Limited.**

It shall be unlawful for the operator of any vehicle to park said vehicle on any street for a period of time longer than thirty (30) minutes between the hours of (2) A. M. and (6) A. M. of any day.

Note to Section 32. This section is appropriate where it is desired to prohibit all-night parking.

Section 33. **Standing or Parking Close to Curb.**

(a) Except when necessary in obedience to traffic regulations or traffic signs or signals, the operator of a vehicle shall not stop, stand or park such vehicle in a roadway other than parallel with the edge of the roadway, headed in the direction of traffic, and with the curb-side wheels of the vehicle within 1 ft. of the edge of the roadway, except as provided in the following three paragraphs:

(1) Upon those streets which have been marked or signed for angle parking, vehicles shall be parked at the angle to the curb indicated by such marks or signs.

(2) In places where, and at hours when,

stopping for the loading or unloading of merchandise or materials is permitted, vehicles used for the transportation of merchandise or materials may back into the curb to take on or discharge loads, when the owner of such vehicle holds a permit granting him such special privilege, and provided further that such permit shall be either in the possession of the operator or on the vehicle at the time such vehicle is backed against the curb to take on or discharge a load, and it shall be unlawful for any owner or operator to violate any of the special terms or conditions of any such special permit.

(3) On a street where there is a perceptible grade a vehicle when stopped or left unattended shall have a front wheel or a rear wheel turned at an angle against the curb.

(b) The (traffic authority) shall determine upon what streets angle parking shall be permitted and shall mark or sign such streets or cause the same to be marked or signed.

(c) The (traffic authority) is hereby authorized to issue, to any owner of a vehicle used to transport merchandise or materials, a special permit, renewable annually, and to state therein the terms and conditions thereof, allowing the operator of such vehicle the privilege of loading and unloading while the vehicle is backed against the curb, if in the opinion of the (traffic authority) such privilege is reasonably necessary in the conduct of the owner's business and will not seriously interfere with traffic.

Note to Section 33, Paragraph (a) (2) and (c). These provisions are designed to permit, under the conditions stated, the backing of a vehicle to the curb for purposes of loading or unloading. While this practice should be discouraged as a serious interference with other vehicular movement on roadways, it is realized that it is difficult to load or unload certain present equipment from the side. Trucks can now be equipped at low cost, however, so that they can be elevated to unload such material as coal from either side or from the rear.

ARTICLE VII
OPERATION OF VEHICLES

Section 34. **Drive on Right Side of Street.**

Upon all streets, except upon one-way streets, the operator of a vehicle shall drive the same upon the right half of the street and shall drive a slow moving vehicle as closely as possible to the right-hand edge or curb of the street unless it is impracticable to travel on such side of the street, and except when overtaking and passing another vehicle subject to the limitations applicable in overtaking and passing set forth in this Ordinance.

The foregoing provisions of this section shall not be deemed to prevent the marking of lanes for traffic upon any street and the allocation of designated lanes to traffic moving in a particular direction or at designated speeds.

Section 35. **Overtaking a Vehicle.**

The operator of any vehicle overtaking another vehicle proceeding in the same direction may pass to the left or the right thereof under conditions to permit safe passage. The operator of such overtaking vehicle shall pass at a safe distance to the side of such overtaken vehicle and shall not cut in front of the latter until safely clear of the overtaken vehicle.

Note to Section 35. The original text of the Uniform Vehicle Code on this subject, which required that all overtaking be on the left, was modified by the National Conference of Commissioners on Uniform State Laws at a meeting at Buffalo, August 23-29, 1927, to provide for overtaking on the right in business or residence streets in cities where this can be done with safety. Section 35 above permits such overtaking on any city street under proper conditions, and is recommended as simpler and more easily enforced than that adopted at Buffalo.

Section 36. **Limitations on Privilege of Overtaking and Passing.**

(2) The operator of a vehicle shall not drive to the left side of the center line of the traversable roadway in overtaking and passing another vehicle proceeding in the same direction unless such left side is clearly visible and is free of oncoming traffic for a sufficient distance ahead to permit such overtaking and passing to be made in safety.

The foregoing provision of this section shall not apply upon one-way streets or upon streets laned for traffic, in which latter event, vehicles traveling in lanes shall move in the direction permitted in such lanes.

(b) The operator of a vehicle shall not overtake and pass any other vehicle proceeding in the same direction at any intersection of streets, except that this provision shall not apply at intersections where traffic is controlled by traffic control signals or by police officers.

Section 37. **Operator to Give Way to Overtaking Vehicle.**

(a) The operator of a vehicle upon a street shall not deviate from his direct line of travel without ascertaining that such movement can be made with safety to other vehicles approaching from the rear and about to overtake and pass such first mentioned vehicle.

(b) The operator of a vehicle upon a street about to be overtaken and passed by another vehicle approaching from the rear shall give way consistent with safety upon suitable and audible signal being given by the operator of the overtaking vehicle, and shall not increase the speed of his vehicle until completely passed by the overtaking vehicle.

Note to Section 37. Section 37 is a departure from the Uniform Vehicle Code made necessary by the provision in Section 35 that vehicles may overtake on either the left or the right.

Section 38. **Turning at Intersections.**

(a) **Right Turns.** The operator of a vehicle intending to turn to the right at an intersection or into an alley or driveway shall approach the point of turning in the line of traffic nearest the right hand edge or curb of the street, and in turning, shall keep as closely as practicable to the right hand curb or edge of the street.

(b) **Turning Left.** The operator of a vehicle intending to turn to the left at an intersection or into a driveway shall approach the point of turning in the lane for traffic to the right of and next to the center of the roadway, and, unless otherwise directed by "turning markers," the operator of a vehicle in turning left at an intersection shall pass to the right of the center of the intersection before turning. Upon streets laned for traffic and upon one-way streets a left turn shall be made from the left lane of traffic.

(c) **Turning Markers.** The (traffic authority) is hereby authorized to place turning markers within or at the entrances to intersections, directing that traffic turning left shall follow a line of travel other than as directed in subdivision (b) of this section. Whenever turning markers have been placed as herein provided, traffic turning left shall follow the line as directed by such markers.

(d) **Turning Left on "Go" Signal.** The operator of a vehicle or street car intending to turn to the left at an intersection where traffic is controlled by traffic control signals or by a police officer, shall proceed to make such left turn with proper care to avoid accident and only upon the "Go" signal, unless otherwise directed by a police officer.

Note to Section 38(d). Where there are exceptions to turning on the green or "Go" signal which controls the straight or through movement, the last line of this subsection should be supplemented by the words "or by official traffic signs, or special signals effective both day and night." (See note to Section 9.)

Section 39. **When Turning Around at Intersections Prohibited.**

At any intersection where traffic is controlled by traffic control signals or by a police officer, it shall be unlawful for the operator of a vehicle to turn such vehicle at the intersection in a complete circle or so as to proceed in the opposite direction.

Section 40. **Turning Around in Midblock Prohibited (Optional).**

The operator of a vehicle shall not within a business district nor upon any through street in a residence district turn such vehicle so as to proceed in the opposite direction except at an intersection.

Section 41. **Emerging from Alley or Private Driveway.**

The operator of a vehicle emerging from an alley, driveway or garage shall stop such vehicle immediately prior to driving onto a sidewalk or onto the sidewalk area extending across any alleyway.

Section 42. **Vehicles Shall Not Be Driven on Sidewalk.**

The operator of a vehicle shall not drive within any sidewalk area except at a permanent or temporary driveway.

Section 43. **Operation of Vehicles on Approach of Authorized Emergency Vehicle.**

(a) Upon the approach of any authorized emergency vehicle or vehicles giving audible signal by bell, siren or exhaust whistle, the operator of every other vehicle shall immediately drive the same to a position as near as possible and parallel to the right hand edge or curb of the street, clear of any intersection, and shall stop and remain in such position until the authorized emergency vehicle or vehicles shall have passed, unless otherwise directed by a police officer; and the operator of every street car shall immediately stop such car clear of any intersection and keep it in such position until the authorized emergency vehicle or vehicles shall have passed, unless otherwise directed by a police officer.

Section 44. **Following Fire Apparatus Prohibited.**

It shall be unlawful for the operator of any vehicle, other than one on official business, to follow closer than five hundred feet any fire apparatus traveling in response to a fire alarm, or to drive into or stop any vehicle within the block where fire apparatus has stopped in answer to a fire alarm.

Note to Section 44. Municipalities may desire to substitute the words "a city block" for the limitation of five hundred feet.

Section 45. **Stop Before Entering Through Street.**

The following streets and parts of streets are hereby declared to constitute through streets for the purpose of this section:

.....

.....

Every operator of a vehicle, street car or other conveyance traversing any street intersecting any through street above designated, shall bring such vehicle, street car or conveyance to a full stop at the place where such street meets the prolongation of the nearest property line of such through street, subject, however, to the direction of any traffic control sign or signal or any police officer at such intersection.

The operator of any vehicle who has come to a full stop as required above, upon entering the through street, as well as operators of vehicles on such through street, shall be subject to the usual right-of-way rule prescribed by law and applicable to vehicles at intersections.

The (traffic authority) is hereby authorized and required to place and maintain or cause to be placed and maintained on each and every street intersecting a through street designated above, and at or near the property line of the through street, appropriate signs upon the street (and in addition thereto may place and maintain any appropriate devices or marks in the roadway), such signs, devices or marks to bear the word "Stop" and to be located in such position and to be provided with letters of a size to be clearly legible from a distance of at least one hundred feet along the street intersecting the through street. All such signs shall be illuminated at night or so placed as to be illuminated by street lights or by the headlights of approaching motor vehicles.

Section 46. **One-Way Streets.**

Upon the following streets, vehicular traffic shall move only in a ( ) direction.

.....

.....

A sign indicating the direction of traffic shall be erected and maintained at every intersection where movement in the opposite direction is prohibited.

Note—Article VII of the Ordinance set forth above includes those regulations covering the operation of vehicles which it is recommended be included in a municipal traffic ordinance, except in case such regulations are in conflict with the state vehicle law, or duplicate provisions in the state law in a state in which legal action must be brought under the state law (and may not be brought under the duplicating local ordinance).

State vehicle laws include additional regulations and rules of the road, such as restrictions as to speed and prohibitions against reckless driving. In general it is believed that such state law provisions need not be and should not

be repeated in municipal ordinances. However, it is recognized that in some states it is necessary for purposes of local enforcement to repeat state law provisions in municipal ordinances, and in some states, furthermore, the matters are not fully covered by the state law. With tions and rules of the road, such as restrictions adapted from the Uniform Vehicle Code approved by the National Conference on Street and Highway Safety immediately follow the proposed Ordinance proper (page 34).

ARTICLE VIII
MISCELLANEOUS PROVISIONS

Section 47. **Motor Vehicles Left Unattended Brakes to Be Set and Engine Stopped.**

No person having control or charge of a motor vehicle shall allow such vehicle to stand on any street unattended without first setting the brakes thereon and stopping the motor of said vehicle, and, when standing upon a perceptible grade, without turning the front wheels of such vehicle to the curb or the side of the street or highway.

Section 48. **Use of Coasters, Roller Skates, and Similar Devices Restricted.**

It shall be unlawful for any person upon roller skates, or riding in or by means of any coaster, toy vehicle, or similar device, to go upon any roadway except while crossing a street on a crosswalk.

Section 49. **Clinging to Moving Vehicles.**

It shall be unlawful for any person traveling upon any bicycle, motor cycle, coaster, sled, roller skates, or any toy vehicle to cling to, or attach himself or his vehicle to any other moving vehicle or street car upon any roadway.

Note to Section 49. Improper riding in or upon any street car or vehicle is prohibited in Sections 22, 52 and 54.

Section 50. **Unlawful to Drive Through Processions Unless Directed by Traffic Control Signals or by a Police Officer.**

It shall be unlawful for the operator of any vehicle or street car to drive between the vehicles comprising a funeral or other authorized procession while they are in motion, provided that said vehicles are conspicuously so designated. This provision shall not apply at intersections where traffic is controlled by traffic control signals or police officers.

Section 51. **Backing Around Corners or Into Intersections Prohibited.**

It shall be unlawful for the operator of any vehicle to back such vehicle around a corner at an intersection, or into an intersection of public streets.

Section 52. **Obstruction to Operator's View or Driving Mechanism.**

(a) It shall be unlawful for the operator of any vehicle to drive the same when such vehicle is so loaded, or when there are in the front seat of such vehicle such number of persons, as to obstruct the view of the operator to the front or sides, or to interfere with the operator's control over the driving mechanism of the vehicle.

(b) It shall be unlawful for any passenger in a vehicle or street car to ride in such position as to interfere with the operator's view ahead, or to the sides, or to interfere with the operator's control over the driving mechanism of the vehicle.

Section 53. **Crossing Fire Hose.**

No street car or vehicle shall be driven over any unprotected hose of the Fire Department when laid down on any street, private driveway or street car track to be used at any fire or alarm of fire, without the consent of the Fire Marshal or Fire Department official in command.

Section 54. **Riding on Handle Bars Prohibited.**

It shall be unlawful for the operator of any bicycle or motorcycle, when upon the street, to carry any other persons upon the handle bar, frame or tank of any such vehicle, or for any person to so ride upon any such vehicle.

Section 55. **Lights on Parked Vehicle.**

Whenever a vehicle is parked or stopped on a street during the times between one-half hour after sunset and one-half hour before sunrise or at any other time when there is not sufficient light to render clearly discernible any vehicle on the street from a distance of 200 feet, there shall be displayed upon such vehicle one or more lamps, projecting a white light visible under normal atmospheric conditions from a distance of 500 feet to the front of such vehicle and projecting a (yellow or red) light visible under like conditions from a distance of 500 feet to the rear, except that such parking light or lights need not be displayed upon any vehicle stopped or parked in accordance with other provisions of this Ordinance upon any brightly lighted street designated by proper authority.

ARTICLE IX
PENALTIES AND PROCEDURE ON ARREST

Section 56. **Penalties.**

Any person violating any of the provisions of this Ordinance or any rule or regulation made by the (Board of Police Commissioners) pursuant thereto, shall be guilty of a misdemeanor, and upon conviction thereof, shall be punished as follows:

Section 57. **Procedure upon Arrest.**

Section 58. **Disposition of Fines and Forfeitures.**

All fines or forfeitures collected upon conviction or upon the forfeiture of bail of any person charged with a violation of any of the provisions of this Ordinance shall be paid into the city treasury and deposited in the ( ) Fund and be expendable for the following purposes:

.....

.....

Section 59. **Effect of Ordinance.**

If any section, subsection, sentence, clause or phrase of this Ordinance is for any reason held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this Ordinance. The (City Council, Board of Trustees) hereby declares that it would have passed this Ordinance and each section, subsection, sentence, clause and phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses or phrases be declared unconstitutional.

Section 60. **Repeal.**

Ordinance No. ..... (Former Traffic Ordinance of the city) of this (city) is hereby repealed, and all ordinances or parts of ordinances in conflict with or inconsistent with the provisions of this Ordinance are hereby repealed, except that this repeal shall not affect or prevent the prosecution or punishment of any person for any act done or committed in violation of any ordinance hereby repealed prior to the taking effect of this Ordinance.

Section 61. **Publication of Ordinance.**

The (City Clerk) shall certify to the passage of this Ordinance and cause the same to be published in the ———.

Receptacles for Refuse

The location of the receptacles and the type of receptacles have a very important bearing upon the efficiency of the collection service, and in addition make the streets more presentable upon collection days. In Toronto, Ont., the enforcing of the by-law in this respect is carried out by two inspectors attached to the head office, who work in defined areas each day, distributing warning and notice cards, and advising householders in order that greater co-operation might prevail.

The co-operation of the public is essential, and this can be secured to a great extent by an efficient system. Laxity upon the part of the collection service will soon breed indifference among the householders.

The accompanying cut is a reproduction of one of several notice cards used by the street cleaning department in order to encourage the householders to provide standard regulation receptacles. The card is 6½x3⅝ in., with a blotting surface on the reverse side, and has proven to be very effective.

Cost of Refuse Collection

The following comparative table showing the cost of collecting refuse in the principal cities of the United States and Canada was compiled by a committee and submitted at the 1928 conference of the International Association of Street Sanitation Officials:

City	Population	Cost Per Ton to Point of Disposal
Detroit, Mich.	1,500,000	$6.19
Chicago, Ill.	3,000,000	5.84
New Haven, Conn.	180,000	*5.00
Grand Rapids, Mich.	167,000	4.87
St. Paul, Minn.	325,000	4.75
New Bedford, Mass.	125,000	4.69
Spokane, Wash.	125,000	4.65
Columbus, Ohio	285,000	4.48
Cleveland, Ohio	950,000	4.47
San Diego, Cal.	150,525	4.35
St. Louis, Mo.	830,000	4.33
Boston, Mass.	780,000	4.21
Erie, Pa.	128,000	4.06
Washington, D. C.	500,000	3.92
Utica, N. Y.	108,000	3.82
Long Beach, Cal.	140,000	3.70
Akron, O.	235,000	3.31
Baltimore, Md.	817,000	3.30
Hartford, Conn.	175,000	3.02
Buffalo, N. Y.	560,000	2.87
Toronto, Ont.	570,000	2.84
New Orleans, La.	420,000	2.25
Philadelphia, Pa.	2,089,000	2.21
Montreal, Que.	952,875	2.15
Ottawa, Ont.	127,000	1.37
St. Petersburg, Fla.	150,000	1.37
Houston, Tex.	275,000	1.20
Jacksonville, Fla.	146,700	*.40

*Per cubic yard.

DEPARTMENT OF STREET CLEANING

Height 22 Inches
Diameter 14½ "

NOTICE

Householders will greatly assist in collection of refuse by providing regulation receptacles.

Do not mix ashes with garbage, use separate metal receptacles. Tie all loose paper securely in bundles.

Upon regular collection days, leave receptacles in side entrance, near front corner of building where possible. Do not place at curb.

Your co-operation is requested in an endeavor to improve the appearance of the streets upon collection days.

GEO. W. DIES,
Street Commissioner.

Card Distributed to Householders by Street Cleaning Department of Toronto

Methods and Costs of Constructing Brick Pavements at Gulfport, Fla.

Two Three-eighths in. Vertical Fibre Brick on 4 in. Oyster Shell Base

By Y. BRIDDELL

Superintendent Georgia Engineering Co., St. Petersburg, Fla.

DURING the month of May, 1927, we were awarded a contract for paving 12 streets and avenues in Gulfport, Fla., with 2⅝-in. vertical fibre Augusta block and asphalt filler on a base of compact oyster shell 4 in. in depth. We started this work as soon as the contracts were signed.

Grading Operations.—The grading was done with a Byers Bear Cat skimmer scoop and the excavation hauled to the surrounding lots by wagons. Our cut ran from 6 in. to 4½ ft. in depth, and a great deal of hard pan and muck was encountered which had to be removed and good material hauled in to replace this. After the rough grading had proceeded far enough ahead the setting of the concrete curb began.

Concrete Curb.—The curb used was made of a 1:2:4 mix, and was moulded in slabs 5 ft. long, 4 in. wide, and 14 in. deep. The curb was made in a yard on the railroad siding where the materials were handled but once and this made a saving in the construction of the curb. The curb slabs after being poured were allowed to set 14 days and were wet down each day until thoroughly cured. They then were hauled to the streets and set in place. Out of over 47,000 lin. ft. of curb made and set we lost very little by breakage in hauling and setting. Curbing now being well ahead, the fine grade was surfaced and thoroughly wet and 7-ton roller was placed on this and rolled it until it was well packed.

The Shell Base.—A shell base of clean oyster shell was spread in two layers, each layer being well rolled both straight and at an angle until well packed. Then the shell was tested to see that the total base showed 4 in. in thickness. In connection with this will say that shell will compact approximately 33⅓ per cent under rolling.

Laying the Brick.—A sand cushion was next spread on the shell base to a depth not exceeding 1 in., and a surface was made by pulling the cushion to a smooth grade with a hand template. Upon the cushion the brick was laid flat in straight rows across the street, broken brick being used to start the rows and make closures at the end of the rows. When the brick had ad-advanced far enough ahead inspection was started, and brick which were chipped were turned over and if the other side was found free from chips, cracks, or breaks they were allowed to remain. If both sides were defective it was replaced by a good brick. Following our inspection the city inspector went over the pavement marking out all brick found defective which were missed by our inspection. These we replaced with good brick.

On all of the streets we used a 5 in. gutter and a 5 in. crown. The streets ranged in width from 21 to 27 ft.

Rolling the Surface.—The rolling of the surface was done with a 5 ton roller, starting at the crown of the street and rolling in a straight line up and down the block moving slowly and working its way over towards the curb. When the roller reached the curb, it returned to the crown of the street working its way as before towards the opposite curb. When the straight rolling was finished the roller started at an angle of 45 degrees going from curb to curb. This angle rolling removed the kinks and depressions. The surface was finally inspected by the city inspectors for broken brick which were removed, replaced with good ones and tamped into place.

Pavement Filler.—The pavement is now ready for the filler. If sand filler is used, the sand is hauled or thrown in from the sides of the street, being raked and swept into the cracks until well filled. If asphalt filler is used the

Completed Street at Rolyat Hotel. The White Piles in Gutters Are the Sand That Has Washed Down from Sides. This Will Be Prevented in Future as Soon as Grass Has Been Planted

Views of Construction Operations on Brick Paving Job at Gulfport, Fla. (1) Grading with the Skimmer Scoop, (2) Spreading and Rolling Shell Base, (3) Laying the Brick, (4) Heating and Drawing Asphalt, (5) Pouring Hot Asphalt on Brick Pavement

pavement is swept before pouring the asphalt. The asphalt that we used was Texas Number 39 which is a special asphalt for brick pavement. It was heated in kettles until it has reached a temperature of 200°C (392°F) and applied at a temperature not exceeding 350°F). The pouring was done by use of wheel carts which carry the asphalt from the kettles to the pavement. The cracks were filled by pulling a squeegee back and forth until surface is smooth.

Where air pockets formed and bubbles appeared this was touched up with squirt cans until the surface had a smooth uniform appearance. Sand was next thrown on the asphalt and the street is ready for traffic.

Brick.—The bricks used on this contract were the Augusta block made by the Georgia Vitrified Brick & Clay Co., of Augusta, Ga. The following size vertical fibre brick was used 8½ in. x 4 in. x 2⅝ in.

Inspection of all brick was made at the plant at Campania, Ga., by the Nutting Testing Labratory, of Cincinnati, O. This company was employed by Gulfport to make the tests at the plant before shipments were made. Shipments were entirely of No. 1 brick, the requirements being that they must be evenly burned, thoroughly annealed, regular in size and shape, and when broken must show a uniformity of texture and structure and be free from

Section of Road Showing Brick Being Rolled

lime, air pockets, cracks and open or marked laminations. They must not be fire flashed, smoked or treated in any manner tending to give artificially a uniform color outside. Kiln marks must not exceed 3-16 in., and one side at least shall show but slight kiln marks. All brick so distorted in burning as to lay unevenly in the pavement shall be rejected.

Bids.—Bids were asked two ways, cash and certificate plan, the certificate plan being used. This plan gives the property owner the option of paying for his paving all at once, or in ten equal payments at 8 per cent interest per year. All engineering fees legal and advertising costs were charged to the property owner as a part of the total cost. All intersections were included in this cost and were charged to the property owner by taking the entire cost of the street and prorating same per property foot equally. The property owner assume all costs in connection with building of the streets.

Our contract covered five miles of streets, and was completed in 120 days.

Costs.—The itemized costs of the work were as follows:

Grading:	Per Cu. Yd.
Earth Excavation	$0.30
Hard Surface	.40
Shell Base:	**Per Sq. Yd.**
Shell 4 in. Compacted Sq. Yd.	$0.275
Labor Spreading and Rolling	.046
Cushion Hauled and Spread	.0098
Miscel. Charges	.0202
Total Base	$0.3510
Laying Brick:	**Per Sq. Yd.**
2½ in. Labor Wet and Roll Foundation	$0.0063
Labor Sand Bed	.0281
Labor Lay Brick	.0291
Inspection	.0178
Labor Batting	.0099
Labor Sanding	.0071
Labor Rolling	.0050
Labor clean up	.0078
Miscellaneous	.0200
Brick lay 34 to Square Yard.	
Asphalt Filler:	**Per Sq. Yd.**
Labor Sq. Yd.	$0.0217
Asphalt at $26.50 ton	.14449
Miscellaneous Charges	.0100
Texas Filler, run with brick laid flat, 11 to 12 lb. to sq. yd.	
Concrete Curb:	**Per. Lin. Ft.**
4x14 in., per ft.	$0.37

Note: The miscellaneous charges in the above items, takes care of hauling labor, to and from work, sickness of foremen, idle time by holidays, rain, cashier and superintendent salaries, office rent, gas and oils on cars used on the work.

Wage Rates.—The rates of wages prevailing were as follows:

Common labor, per hour	$ 0.30
Foreman, per week	40.00
Roller operators, per hour	0.70
Bricklayers, per hour	0.50
Batters, per hour	0.35
Truck drivers, per hour	0.55
Skimmer scoop operators, per hour	1.00
Mule skinners, per hour	0.30

Cost of Street Cleaning at Los Angeles, Calif.

The following is taken from the annual report of the Engineering Department of Los Angeles, Cal., of which John C. Shaw is City Engineer. The work is for the fiscal year ended June 30, 1927.

The paved street cleaning branch consists of the downtown congested area, bounded by Figueroa St., Washington St., Macy St., Sunset Blvd. and the Los Angeles River, and is divided into two sweeping districts under the supervision of two sweeping foremen—District No. 1 employing 72 hand-broom sweepers and three 3-ton pickup trucks; District No. 2 employing 68 hand-broom sweepers and three 3-ton pickup trucks, and one team.

This area is patrolled by the street sweepers from 8:00 A. M. until 5:00 P. M., with the exception of the more congested section, which is swept from 5:00 A. M. until 6:00 P. M. The remaining paved streets in the city (not included in the boundary as given above) are swept under the supervision of the district foreman—each foreman having a number of hand-broom sweepers and a 3-ton truck for pick-up purposes. No provision has been made by the city council for any increase in the number of hand-broom sweepers allowed this department for sweeping newly accepted paved streets. Streets are being paved and accepted for maintenance at the rate of approximately 15 miles per month. This division operates 11 motor flushers and six vacuum sweepers. The operation of the flushers and sweepers during the daytime is under the supervision of the street maintenance foreman. The flushers operating on the night shift are under the supervision of a night flushing foreman, and flush the streets in the district bounded by Figueroa St., Santa Barbara Ave., the Los Angeles River and Sunset Blvd.; also any outlying district which is congested by heavy traffic and parking during the day. The volume of day flushing has been materially lessened, due to the fact that approximately 50 per cent of their time is required on wetting down streets for scarifying and oiling jobs, and also, for the sprinkling of detours where new construction work is in progress.

The streets for which no additional hand sweepers have been allowed receive the regular cleaning service that is afforded oiled streets, which is approximately once every four months.

Cleaning Paved Streets

Miles of Paved Streets, July 1, 1926	1,001.10
Miles of Paved Streets, May 1, 1927	1,176.96
Increase of	175.86

Hand Sweeping

	Average Miles Paved Streets	Cost Per Mile Per Day
Streets in congested district	81.49	$10.11
Streets in semi-congested, residential and outlying districts	722.45	1.95
Streets not receiving cleaning service	372.02	.....

Vacuum Cleaning

	1926-1927
Total miles of streets swept	1,577.00
Total machine shifts operated (8 hours)	492.50
Total sq. yds. of surface swept	13,319,877.00
Average miles of streets swept per machine shift	3.20
Average sq. yds. swept per machine shift	27,045.00
Cost per mile of street swept	5.48
Cost per 1,000 yds. of surface swept	64.93

Water Borne Diseases and the Law

A Discussion of Supreme Court Decisions

DECISIONS handed down by the Supreme Courts of various states on the legal responsibility of a city for the quality of the water it supplies its citizens have been collected by James E. Foster. In the June issue of Hygeia, the health magazine published by the American Medical Association Mr. Foster gives an interesting discussion of the conclusions he has reached from a study of these court decisions. We quote from his article as follows:

"The Supreme Court of the State of Washington, Oct. 13, 1925, upheld a verdict for $60,000 previously awarded by a lower court to Gertrude Mary Roscoe against the city of Everett. Mrs. Roscoe sued the city for damages after her husband had died from typhoid, which he contracted by drinking polluted water that had been distributed through the municipal water works system.

"This decision is cited for two reasons. It shows first of all that a city is legally responsible for the quality of the water it furnishes its citizens and is held liable for any illness that may result from the supplying of polluted water. Furthermore, the case in point is sufficiently typical of other decisions to be a fair example of our courts' attitude on this matter.

What the Courts Have Upheld.—In general the courts have upheld the following propositions:

A city is liable for any disease that may be contracted from impurities in the water it distributes. It must therefore keep this water free from pollution.

It cannot shift this responsibility.

It cannot legally dispose of untreated sewage by dumping it into a natural waterway.

If it does so, it is liable for any illness caused its citizens as a result of the polluted condition of the waterway.

The courts base these contentions on the fact that when a city distributes drinking water or disposes of sewage, it enters the field of private business, and as a consequence must be liable for any injuries its activities may cause. In this connection Judge Elliott of the Minnesota Supreme Court said: "When the municipality enters the field of private business, it does not exercise governmental powers. Its purpose is not to govern the inhabitants, but to make for them and itself private benefit. When a municipality enters into a private enterprise for profit, it should have the same rights and be subject to the same liabilities as private corporations or individuals."

Principal cases on legal responsibility for water-borne diseases that have been brought before Supreme Courts: 239 Pacific 831; 97 Minn. 373; 101 Wis. 258; 113 Minn. 55; 73 N. H. 209; 145 Ill. 23; 158 Ill. 21; 87 N.J.L. 106; 154 N.W. 640.

The theory that the city is to be treated as a corporation when it sells water leads to the question: "How would a private company be treated under similar conditions?" In recent years, the majority of the water supply systems have been under municipal operation; however, there have been (and there still are) cities that secure their drinking water from private firms.

City Treated as Private Water Company.—As private water companies were more numerous in the past, cases against them are less common today than formerly. For this reason, it may be permissible to go back a few years to cite a court's attitude on a private concern's responsibility for disease caused by polluted water.

"In 1898, the Wisconsin Supreme Court upheld a verdict brought against the Ashland Water Company. In its opinion the court said that if the company knew or should have known that the water it was distributing was dangerous for domestic use, it was obligated to notify its customers of the condition of this water, and that a failure to do so was a fraud in the eyes of the law.

"From this it can be seen that an independent firm is legally resonsible for the quality of the water it sells. Since a municipaity is to be treated as a private corporation when it supplies water to its citizens, it follows logically that the city should be liable for any injuries it causes its citizens by supplying them with polluted water.

"A Minnesota Decision.—This principle of municipal resonsibility was the subject of an important decision handed down by the Minnesota Supreme Court in 1910. The facts of the case were: Louis Eugene Keever and F. R. Flanagan died from drinking polluted water supplied by the city of Mankato. An investigation showed that sewage was allowed to enter the water works system. The widows of these men sued the city and were awarded damages. The case was brought to the Supreme Court, which upheld the judgment of the lower court.

"Fear of Liability Stimulates Care.—The decision said in part: 'It is obvious that a sound public policy holds a city to a high degree of faithfulness in providing an adequate supply of pure water. Nor does it appear why the citizens should be deprived of the stimulating effects of the fear of liability on the energy and care of its officials; nor why a city should be exempt from liability while a private corporation under the same circumstances should be held responsible for its conduct and made to contribute to the innocent persons it may have damaged.'

"From this decision, one may conclude that when a city supplies its people with water, it must keep this water pure. The city becomes, as far as responsibility is concerned, a private corporation when it operates a water works system, and as a consequence must make financial reparation for any injuries it causes.

"In delivering the opinion in this case, Judge Jaggard made the following statement: 'Public policy requires the conservation of human life, the preservation of public health, and the establishment of public sanitation on a firm and certain basis in the law.'

"City Cannot Shift Responsibility.—The fact that a city cannot shift the responsibility for sickness caused by polluted water was upheld when Mrs. Roscoe sued the city of Everett, Wash. The pollution that was responsible for her husband's death was caused by a by-pass connecting with a local mill. The city knew of this condition and secured a promise from the mill company to remove the injurious by-pass. This promise on the part of the company did not relieve the city of its natural responsibility, and as a consequence, the Supreme Court found the verdict against the city of Everett a just one.

"The right of a city to dispose of its sewage has been limited by the decisions of several state supreme courts. The substance of these decisions is that no city may pollute a natural waterway, and that if it does, it is liable for any ill effects of its action.

"The Supreme Court of New Hampshire sustained a verdict against the city of Dover in which the evidence showed that the city had dumped its sewage into a natural stream with the result that a nearby resident contracted a water-borne disease and died. In its opinion the court stated that a city is liable for negligence in the construction and maintenance of its sewers. In other words, if a city maintains sewers, it must build and operate them in such a way that they will not endanger public health.

"Recent decisions of the Supreme Court of Illinois have been even more specific. In one case the court said that if a city builds a sewer that empties into a creek outside the city limits, it must see that the sewage will flow off without endangering the health of that locality.

"Protection for Those Outside City Limits.—In this decision, it is probable that the reference to the city limits does not restrict the application of the principle of law which guided the court. The case was one in which water had been polluted outside the limits of a city, and as a consequence, the decision was given to apply directly to the problem on hand. The court in fact recognized the broader application of this principle, for in giving its opinion, it said: 'The city has no right to empty the contents of one of its sewers at a point inside or outside of the city, when it may endanger the health or life of a citizen, and escape liability.'

"In another case, the Illinois Supreme Court declared that a municipal corporation cannot empty its sewage into a stream of water when the water will be polluted as a result.

"The first of these decisions of the Illinois court places definite responsibility on the city that dumps its raw sewage into a natural waterway by assuring the injured person of his right to redress. In substance, it says to the cities: 'If you dump raw sewage into natural waterways, you are endangering the health of those who drink this water. If any one is injured as a result of your action, he can collect damages from you in our courts.'

"Stream Pollution Forbidden.—Both of these decisions tacitly recognize the conditions under which a municipal sanitary district operates. Neither, it will be noted, forbids the city to dump its sewage into a stream. Each, however, prohibits stream pollution.

"A city may for practical purposes do one of two things with its sewage. It may collect it and carry it directly to adjoining waterways or it may first treat it so that the water is harmless before it reaches the streams. Under modern conditions, the sewage must be sent to our waterways. The only question regarding its disposal is: Shall it be deposited in our streams in its raw state or shall it first be transformed into harmless water? The Supreme Court of Illinois has recognized present day necessity; instead of prohibiting cities from dumping their sewage into natural waterways, it has told them that if they pollute streams and rivers, they must pay for their carelessness.

"Public Sanitation Must Be Established.—The tendency of state courts is to hold cities responsible for the quality of the drinking water they furnish and for the disposition of the sewage they collect. They recognize that public health work forms an important part of a municipal government's activities, and that the people are entitled to proper protection against the dangers to which an indifferent or a careless city administration might expose them. In spirit they give practical recognition to the soundness of Judge Jaggard's opinion: 'Public policy requires the conservation of human life, the preservation of public health, and the establishment of public sanitation on a firm and certain basis in the law.'"

Payments by Water Department to City for Service of Other Departments

Information on the above subject collected by the Municipal Reference Division of the Seattle, Wash., Public Library for the Water Department of that city, by means of a questionnaire sent to the 33 cities of this country of over 200,000 population, is summarized below.

The following cities reported some payment to city funds:

Akron. Streets and sewers division paid for labor.

Cincinnati. Rent for quarters in City Hall.

Cleveland. $26,000 for rent, heat, light and telephone.

Denver. Gets services of city attorney only. Pays fee for permits to open streets, and annual inspection fees for boiler inspection, etc.

Detroit. Pays for general labor supplied by other departments.

Indianapolis. Private company.

Kansas City, Mo. Rent $500 per month.

Milwaukee. Does not pay for service but gives no free water. Before department became self-supporting it received aid from tax funds amounting to $1,877,538. Surplus earnings of $5,117,965 have since been paid the city.

Minneapolis. $3,500 per year to City Treasurer for clerical help in collection of water bills.

New Orleans. Sewerage-Water Board is a complete organization, distinct from the city government.

New York. No payment, but surplus revenue is paid into the general fund.

Oakland. Private company.

Omaha. Utilities District is distinct from all other city departments. Street Department occasionally renders service and that is paid for. County Treasurer is ex-officio Utilities District treasurer and receives part of his salary from the District.

San Francisco. Private company.

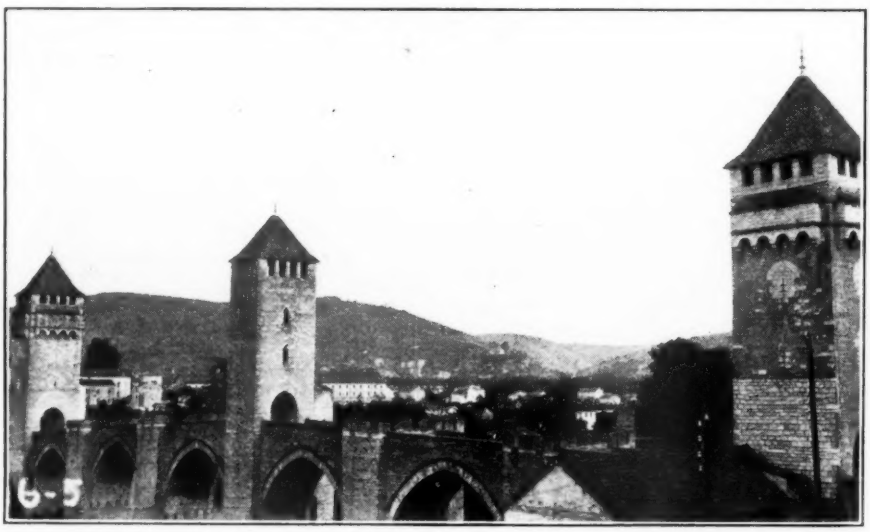
Seattle. Rent for quarters in City Hall. City retains interest on water department bank balances.

The following cities report no payment:

Baltimore, Los Angeles, Louisville, Portland and Washington. Information is not available concerning the remaining cities.

Cost of Refuse Collection at Toronto, Ont.—The total cost of the refuse collection service at Toronto, Ont., for 1927 including administration, insurance, compensation, feeding and care of horses, repairs to vehicles and upkeep of plant, amounted to $1,112,500. The following details are taken from the 1927 report of George W. Dies, Street Commissioner:

Number of buildings collected from	121,062
Collection calls per annum	12,106,200
Actual cost per collection per building	$0.07
Total cost per collection per building	$0.09
Total cost per ton	$2.84
Average tonnage of ashes and garbage collected from each building during the year 1926	4.0
Cost per building per year	$9.19



Thirteenth Century Bridge at Cahors, France. This Structure Has Had Six or Seven Centuries of Use and is Still Serviceable and Shows No Great Deteriation. It Was Built Apparently With the Idea of Permitting Friendly Traffic, But of Preventing Unfriendly Traffic Across the River. The Three Towers Were Each Provided With Gates and Openings Were Left at the Top So That Missiles Could Be Hurled on the Enemy. There Also Were Loops or Portholes for the Small Weapons of the Time

Meter Rates in Municipalities of Over 200,000 Population

Results of a Questionnaire Sent to 34 Cities

SOME interesting information on meter rates in large cities has been obtained recently by the Municipal Reference Division of the Seattle Public Library at the request of the Water Department of Seattle, Wash. Letters were sent to the Water Departments of the 34 cities of over 200,000 population. Through the courtesy of the Municipal Research Division we are able to print below the results of their investigation:

Eight of the 34 departments did not reply. The latest information available for these cities is included for the sake of completeness, with authority given in each case. Very often the only information available was that given in a similar compilation made by the Seattle Public Library in 1924. "1924 information" refers to the former report.

The population figures are U. S. Census Bureau estimates of 1927 unless otherwise stated.

The percentage of metered sources is taken in most cases from a table compiled by the Chicago City Engineer in 1925 and printed in the recent report of the Chicago Department of Public Works on water waste.

Newark has been omitted as no information concerning that city is available.

Akron, O.—(208,435) 1920 census, no. est. 100 per cent metered. First 20,000 cu. ft. per quarter, $1.60 per 1,000; next 20,000 $1.50 per 1,000; next 20,000, $1.40 per 1,000; next 20,000, $1.30 per 1,000; over 80,000 cu. ft., $1.20 per 1,000. Minimum monthly rates: ⅝ in. meter, $1.20 per mo; ¾ in., $2.00; 1 in., $3.00; 1½ in., $4.00; 2 in., $5.00; 3 in., $7.00; 4 in., $10.00; 6 in., $15.00; 8 in., $25.00; 10 in., $40.00.

Atlanta, Ga.—(249,000). Maximum rate 20 ct. per 100 cu. ft.; minimum rate, 10½ ct. per 100 cu. ft. Minimum charge per mo., $1.00 for 500 cu. ft. 1924 rate, no later information received.

Baltimore, Md.—(819,000). 18 per cent metered. First 5,000 cu. ft. per quarter, $2 per 1,000; next 45,000, $1 per 1,000; over 50,000, 75 ct. per 1,000.

(Minimum Quarterly Rates)

⅝ in. meter,	$ 2.00	for	1,000 cu. ft.
¾ in. meter,	3.50	for	1,750 cu. ft.
1 in. meter,	6.00	for	3,000 cu. ft.
1½ in. meter,	10.00	for	5,000 cu. ft.
2 in. meter,	15.00	for	10,000 cu. ft.
3 in. meter,	30.00	for	25,000 cu. ft.
4 in. meter,	50.00	for	45,000 cu. ft.
6 in. meter,	90.00	for	96,667 cu. ft.
8 in. meter,	160.00	for	190,000 cu. ft.
10 in. meter,	225.00	for	276,667 cu. ft.
12 in. meter,	275.00	for	343,333 cu. ft.

Charitable rates: 9 ct. per 1,000 cu. ft. to organizations giving free treatment to over two-thirds of inmates; 12 ct. of free treatment to one-third to two-thirds of inmates; 14 ct. of free treatment to less than one-third of inmates; 39c if no free treatment.

Religious rates: 39 ct. per 1,000 ft.

Educational rates: 48 ct. per 1,000 cu. ft.

Boston, Mass.—(793,100). 94 per cent metered. First 20,000 cu. ft. per year, $1.54 per 1,000; next 20,000, $1.43 per 1,000; next 960,000, $1.32 per 1,000; over 1,000,000 cu. ft., per year $0.88 per 1,000. Minimum charge, $8.80 per year.

Chicago, Ill.—(3,102,000). Meter may be installed on request. 60 ct. per 1,000 cu. ft. 15 per cent discount if paid within 30 days. Information J. Chicago City Council 26 Jan. 1927, p. 5353.

Buffalo, N. Y.—(550,000). First 3,000 cu. ft. per mo., $1.00 per 1,000; next 3,000, 70c per 1,000; over 6,000, 40 ct. per 1,000. Minimum meter rate as follows:

Size of meter	Rate per yr.	Water allowance cu. ft.
⅝ in.	$ 12.00	12,000
¾ in.	15.00	15,000
1 in.	20.00	20,000
1½ in.	30.00	30,000
2 in.	40.00	41,714
3 in.	50.00	56,000
4 in.	100.00	169,000
6 in.	200.00	419,000
8 in.	300.00	669,000
10 in.	400.00	919,000
12 in.	500.00	1,169,000

1924 rate. No later information received.

Cincinnati, O.—(401,247.) 98.6 per cent metered. 12 ct. per 100 cu. ft. Minimum charge, 40 ct. per mo. Charitable rates: Free to the extent of 40 gal. per day per person to charitable institutions; half rates (same limit in amount) to institutions partly supported by fees; ¾ rate to churches, gymnasiums and other community welfare organizations.

Cleveland, O.—(972,600.) 100 per cent metered. 60 ct. per 1,000 cu. ft. Minimum semi-annual rates: ⅝ in. meter, $3.00; ¾ in., $7.50; 1 in., $9.00; 1½ in., $12.00; 2 in., $18.00; 3 in., $37.50; 4 in., $60.00; 6 in., $112.50; 8 in., $200.00.

Columbus, O.—(291,400.) 99 per cent metered. P. W. Je. 1926, p. 187. First 25,000 cu. ft. per mo. $1.20 per 1,000. 25,000 to 200,000 cu. ft., per mo. $1.15 per 1,000; 200,000 to 2,000,000 cu. ft. per mo., $1.10 per 1,000; All over 2,000,000, 60c per 1,000. Minimum charge, 40 ct. per mo. 1924 information with minimum rate as given in Public Works, June, 1926, p. 187.

Denver, Colo.—(289,800.) 2 per cent metered. 1,000 to 15,000 gal. per mo. 17 ct. per 1,000; 15,000 to 30,000, 16 ct. per 1,000; 30,000 to 60,000, 15 ct. per 1,000; 60,000 to 150,000, 13 ct. per 1,000; 150,000 to 315,000, 12 ct. per 1,000; 315,000 to 637,500, 11 ct. per 1,000; 637,000 to 20,000,000, 10 ct. per 1,000; over 20,000,000 gal. per mo., 8 ct. per 1,000. Minimum rate for residence, 25 ct. per month. Minimum rate for business premises, $3.00 per month. No residences are metered. Flat rate for 4-room house, $2.00 semi-annually with 40 ct. additional for every additional 2 rooms.

Detroit, Mich.—(1,334,500.) 99½ per cent metered. First 10,000 cu. ft. per quarter, 65 ct. per 1,000; next 90,000, 50 ct. per 1,000; over 100,000, 40 ct. per 1,000. Minimum charge, $1.25 per quarter. Service charge per year: ⅝ in. meter, $2.40; ¾ in., $3.60; 1 in., $7.20; 1½ in., $14.40; 2 in., $24.00; 3 in., $33.60; 4 in., $43.20; 6 in., $72.00; 8 in., $110.40; 10 in., $158.40; 12 in., $187.20; 16 in., $302.40; 24 in., $532.80.

Indianapolis, Ind.—(374,300.) 30 per cent metered. (Private company.) 1st 700 cu. ft. per mo., 21½ ct. per 100; next 11,300, 14 ct. per 100; next 18,000, 12 ct. per 100; next 20,000, 10 ct. per 100; next 50,000, 8 ct. per 100; next 100,000, 6 ct. per 100. Minimum monthly rates: ⅝ in. meter, $1.50; ¾ in., $4.50; 1½ in., $7.00; 2 in., $11.00; 3 in., $20.00; 4 in., $30.00; 6 in., $50.00. Information from Amer. City Jl. 1926, p. 111.

Jersey City, N. J.—(321,500.) 35 per cent metered. 90 ct. per 1,000 cu. ft. Information from Public Works, Sept. 1926, p. 303.

Kansas City, Mo.—(383,100.) 82.5 per cent metered. First 2,000 cu. ft. 17 ct. per 100; next 2,000, 16 ct. per 100; next 3,000, 15 ct. per 1,000; next 3,000, 14 ct. per 100; next 5,000, 13 ct. per 100; next 5,000, 12 ct. per 100; next 10,000, 11 ct. per 100; next 20,000, 10 ct. per 100; next 50,000, 8 ct. per 100; next 400,000, 7 ct. per 100; all over 500,000, 6 ct. per 100 cu. ft. Minimum charge 50 ct. per month.

Los Angeles, Calif.—(1,200,000), local estimate.) 99 per cent metered. 1st 10,000 cu. ft. per month, 13 ct. per 100; next 40,000, 11 ct. per 100; next 50,000, 9 ct. per 100; all over 100,000, 7 ct. per 100. Minimum charge per month, ⅝ in., ¾ in. or 1 in. meter, $1.00; 1½ in., $1.50; 2 in., $2.00; 3 in., $3.00; 4 in., $4.00; 6 in., $6.00.

Louisville, Ky.—(320,000.) 353 gal. daily or less, 6 ct. per day; 353 gal. per day up to and including first 5,000 gal. daily, 17 ct. per 1,000; then decreasing 1 ct. per 1,000 for each increased 5,000 gal. daily to 8 ct. per 1,000. For all over 50,000 gal. daily, 6 ct. per 1,000. Charitable institutions supplied water free.

Milwaukee, Wis.—(536,400.) 99 per cent metered. 7 ct. per 100 cu. ft. Service charge $2.00 per year.

Minneapolis, Minn.—(447,700.) 100 per cent metered. 8 ct. per 1,000 gal.

New Orleans, La.—(424,000.) 100 per cent metered. Less than 100,000 gal. per mo., 10 ct. per 1,000 gal. All over 100,000 gal. per mo., 7 ct. per 1,000 gal. Service charge per quarter: ⅝ in. meter, 75 ct.; ¾ in., 90 ct.; 1 in., $1.20; 1½ in., $1.80; 2 in., $3.00; 3 in., $4.50; 4 in., $6.00; 6 in., $10.50; 8 in., $18.00; 10 in., $27.00; 12 in., $36.00. One-quarter total consumption, not to exceed 600 gal. per quarter per person, free for sewerage purposes. Information from American City, July, 1926.

New York City—(5,970,000.) 25.7 per cent metered in 1925. 10 ct. per 100 cu. ft.

Oakland, Cal.—(267,300.) 100 per cent metered. (Private company.) First 50,000 cu. ft. per month, 23 ct. per 100; all over 50,000 cu. ft., 19 ct. per 100. Service charge: ⅝ in. meter, 50 ct. per mo.; ¾ in., $1.00; 1 in., $1.50; 1½ in., $2.50; 2 in., $4.50; 3 in., $8.00; 4 in., $12.50; 6 in., $25.00. Subcharge, 10 per cent of charges.

Omaha, Neb.—(219,200.) 97 per cent metered. First 14,000 cu. ft. per mo.; 12½ ct. per 100 cu. ft.; next 36,000, 9 ct. per 100; next 95,000, 7½ ct. per 100; next 1,230,000, 6 ct per 100; all over 2,230,000 cu. ft., 6 ct. per 100 cu. ft., flat rate for total quantity. Minimum monthly rate, 35 ct.

Philadelphia, Pa.—(2,035,900.) 7.7 per cent metered. Minimum meter rates per year and quantities of water allowed therefor.

½ in. ferrule	$ 8.00 minimum,	8,000 cu. ft.
⅝ in. ferrule	12.00 minimum,	12,000 cu. ft.
¾ in. ferrule	18.00 minimum,	18,000 cu. ft.
1 in. ferrule	32.00 minimum.	32,000 cu. ft.
1¼ in. ferrule	50.00 minimum,	50,000 cu. ft.
1½ in. ferrule	75.00 minimum,	75,000 cu. ft.
2 in. ferrule	130.00 minimum,	130,000 cu. ft.
3 in. ferrule	290.00 minimum,	290,000 cu. ft.
4 in. ferrule	515.00 minimum,	515,000 cu. ft.
6 in. ferrule	1,150.00 minimum,	1,150,000 cu. ft.

All water in excess of this fixed amount, 40 ct. per 1,000 cu. ft.

Pittsburgh, Pa.—(665,500.) 40 per cent metered. First 250,000 gal. per quarter, 18 ct. per 1,000 gal; next 250,000, 16 ct. per 1,000; next 250,000, 14 ct. per 1,000; all over 750,000 per quarter, 12 ct. per 1,000. (Public Works, Sept., 1926.)

Portland, Ore.—(258,288, 1920 census, no etsimate.) 100 per cent metered. For the first 20,000 cu. ft. per month, 9½ ct. per 100; all over 20,000 cu. ft., 7½ ct. per 100. Minimum charge, 60 ct. per month.

Providence, R. I.—(280,600.) First 10,000 cu. ft. quarterly, $1.80 per 1,000; next 90,000, $1.20 per 1,000; all over 100,000, 75 ct. per 1,000. Minimum charge, $8.00 per year. 1924 rate. No later information received.

Rochester, N. Y.—(324,500.) 99 per cent metered. First 20,000 cu. ft. or less, per month, $1.35 per 1,000; next 80,000, $1.20 per 1,000; all over 100,000 100,000, 75 ct. per 1,000. Minimum charge $1.50 per quarter.

St. Louis, Mo.—(839,200.) 7.7 per cent metered. Use per 6 mo.

For the first	3,000 cu. ft.	15c per 100
For the next	3,000 cu. ft.	14c per 100
For the next	4,000 cu. ft.	13c per 100
For the next	5,000 cu. ft.	12c per 100
For the next	10,000 cu. ft.	11c per 100
For the next	15,000 cu. ft.	10c per 100
For the next	100,000 cu. ft.	9c per 100
For the next	260,000 cu. ft.	8c per 100
For the next	3,600,000 cu. ft.	7c per 100
For the next	4,600,000 cu. ft.	6½c per 100
For the next	10,000,000 cu. ft.	6c per 100
For the next	18,000,000 cu. ft.	5c per 100

Minimum bill, $1.00. Manufacturing rates to consumers of over 60,000 cu. ft. semi annually; For the 1st 60,000 cu. ft., 10 ct. per 100; next 440,000, 6 ct. per 100; next 500,000, 5½ ct. per 100; for all over 1,000,000 cu. ft., 5 ct. per 100.

St. Paul, Minn.—(250,000.) 99.5 per cent metered. First 10,000 cu. ft. per mo., 9 ct. per 100; 10,000-50,000 cu. ft., 6 ct. per 100; 50,000 to 500,000 cu. ft., 4½ ct. per 100; all over 500,000 cu. ft., 3 ct. per 100. Service charge: ½ in. or ⅝ in. meter, $3.00 per year; ¾ in., $4.20; 1 in., $7.20; 1¼ in., $10.20; 1½ in., $13.20; 2 in., $27.00; 3 in., $60.00; 4 in., $120; 6 in., $240; 8 in., $420; 10 in., $600.

San Francisco, Calif.—(576,000.) 100 per cent metered. (Private company.) First 3,300 cu. ft. per month, 28.8 ct. per 100; next 30,000 cu. ft., 25.2 ct. per 100; all over 33,300, 21.6 ct. per 100. Service charge—monthly: ⅝ in. meter, 78 ct. per mo.; ¾ in., $1.20; 1 in., $1.80; 1½ in., $3.00; 2 in., $5.40; 3 in., $9.60; 4 in., $15.00; 6 in., $30.00; 8 in., $48.00,

Seattle, Wash.—(315,312.) 100 per cent metered. 500 cu. ft. or less, 50 ct. per mo.; over 500 cu. ft., 6 ct. per 100 cu. ft. For manufactories, laundries, motors and elevators, water in excess of 30,000 cu. ft. per mo., 4 ct. per 100 cu. ft.

Toledo, O.—(305,400.) First 10,000 cu. ft. per mo. $1.00 per 1,000; next 150,000, 90 ct. per 1,000; next 1,000,000, 70 ct. per 1,000; over 1,160,000, 50 ct. per 1,000. Minimum monthly charge, 80 ct. Information from Toledo City Journal, June 19, 1926.

Washington, D. C.—(540,000.) 86 per cent metered. Minimum rate, $5.65 per year for 7,500 cu. ft. of water. All in excess of this amount, 5 ct. per 100 cu. ft.

Sanitary Agreement Adopted by Great Lakes States

At a meeting of executive health officers of Minnesota, Michigan, Wisconsin, Illinois, Indiana, Ohio, Pennsylvania and New York, held March 7 at Gary, Ind., these officials drafted and signed the Great Lakes Drainage Basin Sanitation Agreement, the purpose of which is defined in the following resolution:

"Resolved, That the Departments of Health of the States of Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania and New York, represented by the executive health officers of said departments of health, do hereby agree to co-operate with each other and with the United States Public Health Service in carrying out a policy for the improvement of the quality of the waters of these interstate lakes and their tributary streams in these states by the prevention or correction of undue pollution thereof, to the end that the said lakes and tributary streams may be maintained or rendered suitable sources of public water supplies as aforesaid."

Dr. W. F. King, health officer of Indiana, was elected chairman and Dr. I. D. Rawlings, health officer of Illinois, secretary.

The agreement conforms to the general lines and is for similar purpose, as affecting the Great Lakes, as the Interstate Agreement of the Ohio River Drainage Basin, which has been in effective operation for nearly four years.

Influence of Trade Wastes on Sludge Digestion

Preliminary studies of the influence of trade wastes upon sludge digestion were conducted in 1927 by the laboratory of the Department of Sewage Disposal, New Jersey Experimental Station, New Brunswick, N. J. The results of these studies are given in the April 20, Public Health Report by William Rudolfs, Chief of the Department. His summary of results is as follows:

Preliminary studies on the effect of certain trade wastes upon the rate of sludge digestion show that with seeded material—

1. Laundry waste is somewhat detrimental to digestion activities.

2. Sulphur-black dye waste is particularly detrimental when left in contact with the sludge. It is detrimental to a much lesser extent in the digestion of fresh solids when the dye waste is partly removed with some of the supernatant liquid.

3. Comparatively small quantities of H_2SO_4 did not seem to affect digestion processes markedly during the first stages of digestion, and appeared to stimulate them somewhat after a prolonged period of incubation. Larger quantities appeared to retard.

4. Small quantities of NaOH retarded activities slightly and larger quantities more.

5. A mixture of NaOH and H_2SO_4 seemed to be detrimental at the beginning, but this was reversed later.

6. Certain proportions of iron sulphate have little effect on digestion.

Cost Accounting System of the City of Minneapolis

Cost Keeping for Public Work Required by State Law

By GUSTAVE A. MOE
Cost Accountant, Office of City Comptroller, Minneapolis, Minn.

WHILE cost accounting in public service is still in its infancy, Minneapolis has begun by installing a cost accounting system, which is supported by a city ordinance which was passed in July, 1926, setting up the system under the direct supervision of Mr. Dan C. Brown, City Comptroller. Mr. Brown appointed the writer on Aug. 1, 1926 to make the installation and it is the desire to explain in this brief article what has been accomplished since that time.

The State Law.—The state law which compels each political subdivision of the state to keep costs, contains the following provisions:

CHAPTER 274—H. F. NO. 1111.
AN ACT TO REQUIRE MUNICIPALITIES AND POLITICAL SUBDIVISIONS OF THE STATE OF MINNESOTA TO KEEP COMPLETE AND ACCURATE ACCOUNTS OF ALL PUBLIC WORK AND CONSTRUCTION AND OF THE COST THEREOF, DONE FOR OR ON BEHALF OF SUCH MUNICIPALITIES AND POLITICAL SUBDIVISIONS.

Be it enacted by the Legislature of the State of Minnesota.

Section 1. MUNICIPALITIES TO KEEP RECORDS OF COST OF PUBLIC WORKS. NOTICES OF COSTS SHALL BE PRINTED: Whenever a county, city, village, borough, school district or other political subdivision of the State of Minnesota, or any public agency of such municipality or political subdivision, shall determine that any public work or construction is necessary to be done, either by contract or by day labor, or otherwise, an estimate of the cost thereof shall be made, and if such estimate shall exceed the sum of fifteen hundred dollars ($1,500.00) the total amount of such estimate shall be published in the official newspaper of such county, municipality, or political subdivision. If there be no such official paper, the same shall be published in a legal newspaper of the county in which the work is to be done. If the estimated cost of such public work or construction exceeds the sum of fifteen hundred dollars ($1,500.00), such municipality, political subdivision, or public agency shall keep and preserve an accurate record and account of such work and construction, and the cost thereof, whether it be done by contract or by day labor or otherwise. Provided, that where such estimate is published as part of the official proceeding of the governing body of such municipality, public agency or political subdivision, no further publication shall be required under the provision hereof.

Section 2. WHAT SHALL BE SHOWN IN ACCOUNT: The said account shall show in accurately tabulated form, under appropriate heads, the totals of all classes, kinds and descriptions of work performed and of materials entering into such public work or construction, and the cost to such municipality, political subdivision or public agency of each, including the cost of all materials, supplies and services furnished or paid for by said municipality, political subdivision or public agency; and the cost of all labor, when said work or construction is done by day labor, when such public work or construction is done by contract the prices paid to the contractor for, and the amounts paid to him for each class, kind or description of work performed, and materials furnished; and in all cases, the cost of all overhead, the cost of engineering, and all other expenses involved in the total cost of such public work or construction, which total shall be tabulated and distinctly shown.

Section 3. TOTAL COSTS SHALL BE PUBLISHED: The total cost of such public work or construction, upon completion thereof, shall be published in a legal newspaper in the county, city, town, borough or school district in which said work is done, if there be such newspaper published therein. If not, then in some legal newspaper published at the county seat of the county in which said work or construction is performed.

Section 4. RECORDS TO BE OPEN TO THE PUBLIC. CERTIFIED COPIES: The records and accounts hereinabove required to be made and kept, shall be open to inspection by the public at all reasonable times. Certified copies thereof shall be furnished to any citizen of this State on demand, on payment of the legal fee for making and certifying the same.

Section 5. This act shall take effect and be in force from and after its passage.

This state law is made in part a city law by the passing of the above named ordinance establishing the authority for enforcement with the proper city accounting official.

The Four Elements of the Cost Keeping System.—The system is based on the analysis of the four basic elements of expense without which no construction or maintenance can be done, namely, labor, material, equipment and burden or overhead. The success of any system depends upon the personnel which is to handle the system; in short, the system will be no better than the personnel chooses to make it, therefore the educational feature, reflecting to those who give the cost accountant the data, is very necessary. The cooperation between the personnel, such as timekeepers, storehouse clerks, receiving clerks, foremen and engineers in charge of the projects is very necessary to the success of a proper functioning cost accounting system.

The general ledger accounts must necessarily reveal a picture through proper control accounts to which cost accounts may be reconciled. All of the above procedure has been taken by steps to the point of progress now attained.

Before those in charge of the field crews go into the field to construct any public improvements they are called together for the purpose of explaining the manuals that have been prepared and that they may ask questions concerning parts of the procedure not clear to them. These men represent those in charge, such as engineers, foremen, timekeepers and field clerks. This has done much to help the cost accounting movement. At present it is quite noticeable that these men are vitally interested in the costs of their jobs.

Classification and Distribution of Labor.—Labor is divided into two classes—direct labor and indirect labor. Each class is distributed to operation or expense accounts of a project or division of work. Labor distribution forms are used for each type of construction work. Indirect labor charges are applied by the cost clerks of the various departments who also tabulate and report to the heads of departments, the progress and cost daily of each project. On small crews the foreman makes out the labor distribution for his crew, but on large crews a timekeeper is allowed. This timekeeper checks the men four times a day and makes all reports to the foreman.

Materials are handled through classified stores control accounts and warehouse materials are kept by perpetual inventory and stores control accounts. The foreman reports materials used or transferred from job to job upon forms provided for the purpose. All jobs are checked as to the theoretical amounts required and all irregularities are reported promptly.

A master control is also maintained, controlling receipts and disbursements of all materials and supplies purchased —which purchases are made through a central purchasing agent.

Equipment Records.—Equipment records are kept to show the expense and income for all equipment. Each piece of equipment is kept separately so far as expense of operation and maintenance is concerned. Repair shops are governed by a standard cost per each operation of repairs; yard mile, ton mile and units of all operations are compiled. Rental schedules are set up and controlled by the cost accounting department. Rates are continually analyzed as to actual cost against established rates. Changes are made when irregularities are discovered. Much time and care is given to this class of changeable expense.

Spreading Overhead Charges.—Burden and overhead charges are budgeted and scheduled by the cost department for each branch of the city government. These call for very careful analysis, based on previous experience. By this class of expense is meant—engineering, office expense, workmen's compensation, warehouse service expense—and one item of general expense. The latter item carries to each project its charge for services rendered by the various city departments, namely, city engineer, civil service, purchasing agent, city attorney, clerk, treasurer and comptroller.

At present a flat rate for general expense is used.

After having carefully allocated to a job, which in each case is given a number—all of the items of expense as mentioned, then the quantities of work done are assembled to ascertain a unit cost for each of the various operations on a given project. This is what the supervisors want. They like to have this information when it is hot and the cost clerk does his best to fulfill his duty.

Minneapolis does most of the construction work under the supervision of the city engineer by day labor, therefore it is the desire of the cost accountant to see to it that all costs are carefully allocated to a job and that no job pays more or less than its actual cost—which of course is assessed to the property owners on paving, sewers, curb and gutter and street improvements, such as grading and filling.

Installations and assistance in cost accounting have been given to nearly every city department by personal contact since this new system developed. It is the desire of the comptroller to present actual facts so that the public and all concerned will know the actual costs.

As the system grows, the value of it will perhaps be more noticeable as one of the most valuable facts of keeping costs is to be able to make comparisons, and as time goes on this will be possible. A large saving to the public is looked for by the aid of the cost accounting.

City Engineer's Department Has System for Recording Property Ownership

A valuable system of recording land ownership in the city of Hartford, Conn., has been in use in the city engineer's office for many years. The department has a set of maps on which all property transfers are posted each month as they are recorded at the town clerk's office. This set of maps is the most used in the office, and there are few moments during business hours when at least one of these sheets is not in use, and frequently there are several being consulted by various persons at the same time. These property maps show the size, shape, location and ownership of every piece of land in the city of Hartford, together with building and veranda lines and kindred data.

The following account of the origin of this system and its development is taken from the annual report for year ending March 31, 1927, of Roscoe N. Clark, city engineer.

In 1899 the city first undertook to sprinkle a large number of streets and to assess the cost of this work against the abutting property. The preparation of this assessment was entrusted to the city engineer, who found that compiling this list of 5,300 owners was a considerable task. Realizing that this information was of wide interest, the names and frontages in that first sprinkling assessment were copied onto the property maps which had been made a year or two before.

As this sprinkling assessment was to be an annual task the city engineer began on Jan. 1, 1900, to make note of all real estate transfers recorded each day at the town clerk's office. The next year, 1901, a record of these transfers was kept, arranged alphabetically by streets. In 1902 this was amplified by the introduction of the system now in use, whereby each piece of property is assigned a serial key number on the map and in the files, and abstracts of all transfers of that property are filed on cards under that number. Most of this system seems to have been originated in the office of the city engineer of Hartford. It has excited favorable comment from outsiders many times. That this system of keeping track of land ownership was well planned is borne out by the fact that it has continued in use for over a quarter of a century with only minor changes in the general scheme, though expanded to several times its original volume.

The property map now (1927) consists of 171 sheets, 153 sheets, scale 1 in. equals 50 ft., covering most of the built-up portions of the city, fourteen 100 scale sheets of rural parts of the north and south meadows. It is expected that this number will be increased before the summer of 1927 by the substitution of sixteen 50 scale sheets for four of the present 100 scale ones. Other 100 scale sheets will be replotted as soon as it can conveniently be done, until all developed parts of the city are shown on a scale of 50 ft. to the inch.

During the year just closing 31 new tracings of these property maps were made, either to permit re-drawing some sections or to replace worn out tracings.

The ownership is kept posted on positive prints from these tracings. These prints become badly worn from constant use and from the frequent changes which are plotted on them. During the past year 47 new prints were put into service. In making up each of these prints ready for use on the office counter it is necessary to do several days' work lettering on names, building lines, file numbers, etc., so that the preparation of a new counter print involves as much labor as drawing a new tracing.

A complete set of prints of these property maps, showing ownership, building, etc., but not of building lines as of July 1, 1926, was furnished to the Board of Assessors, just as has been done each year for the past twenty years.

Deeds to the number of 3,922, transferring land, were recorded at the town clerk's office during the fiscal year of 1926-27. Abstracts of all of these were made for the files and the proper changes in ownership were lettered on the maps.

The usefulness of these maps and files is not limited to the service which they render to other city departments. They were originally made to facilitate the preparation of assessments, but they have have been found to be very useful for many other purposes. This department gives considerable service direct to the general public by means of these property maps. They are consulted by real estate agents for data respecting property offered for sale or under appraisal. Title searchers come to this office for the bounds of property which they must describe, and from the file of deed abstracts kept in connection with these maps they obtain a chain of title to help them in their search. Credit men and others call this office to ask the ownership of property. The engineering department answers between 50 and 100 inquiries along these lines each day.

1928 Convention of New England Water Works Association

The 47th annual convention of the New England Water Works Association will be held Sept. 18, 19, 20 and 21 at the Hotel Windsor, Montreal, Que. The preliminary program of the convention follows:

PROGRAM
Tentative—Subject to Change
TUESDAY, SEPTEMBER 18
Morning Session, 10 A. M.

Addresses of Welcome.
Reports of Committees and Officers.
Award of Dexter Brackett Memorial Medal.

Afternoon Session, 2 P. M.

Technical Papers.
Committee Reports.

WEDNESDAY, SEPTEMBER 19
Windsor Hall
Morning Session, 9 A. M.

Technical Papers.

Afternoon Session, 2 P. M.

Technical Papers.

Evening Session, 8 P. M.

Technical Papers.

Oak Room
SUPERINTENDENTS' CONFERENCE
Morning, Afternoon and Evening

Sessions will be devoted to Superintendents' Conference. These sessions will be in charge of Stephen H. Taylor, Supt., Water Works, New Bedford, Mass.

(If you have a subject which you desire to have discussed, please communicate with Mr. Taylor.)

THURSDAY, SEPTEMBER 20
Morning Session, 9 A. M.

Visit to Montreal Water Purification Plant.

Afternoon Session, 2 P. M.

Technical Papers and demonstration of Telavox System by the Westinghouse Co.

FRIDAY, SEPTEMBER 21
Morning Session, 9 A. M.

Technical Papers and Business Session.

ENTERTAINMENT
TUESDAY, SEPTEMBER 18

Evening: Informal reception and dance.

WEDNESDAY, SEPTEMBER 19

10:00 A. M. Sightseeing trip for ladies.
2:30 P. M. Entertainment for ladies.
8:00 P. M. Ladies' reception and bridge, Hotel Windsor.

THURSDAY, SEPTEMBER 20

10:30 A. M. Shopping for ladies. Personally conducted by professional women shoppers.
8:00 P. M. Dinner Dance with entertainment at Hotel Windsor for members and guests.

FRIDAY, SEPTEMBER 21

Specially arranged outing and dinner including river excursion and trip through the Lachine Rapids.

General Design Features of Public Swimming Pools

Some of the Features That Make for Safety and Comfort

By V. M. EHLERS

Chief Sanitary Engineer, Texas State Department of Health, Austin

WITH more than 3,000 swimming pools and bathing resorts in the United States today and many more under construction, it is evident that the desire for this type of sport and recreation is increasing. But today, just any "Ole Swimmin' Hole" won't do. The discriminating taste of the American public demands a great many adjuncts to the swimming pool for health protection which the old aristocratic Roman never dreamed of requiring when he went forth to lave his body publicly. True, he wished to have comfort and beauty in his swimming pool, but he knew nothing of the methods by which certain diseases may be transmitted through water and was therefore little concerned with that phase of swimming pool maintenance.

In quest of positive health garnished with amusement, the modern swimmer finds his playground equipped with the essentials for water and sun baths, and in addition, many contrivances which add beauty or increase the pleasure and comfort to be derived from the sport of swimming. But the patronage of a modern swimming pool in a wide-awake community depends primarily upon the loaction of the pool, its construction and maintenance, and upon its reputation of safety in so far as the transmission of disease is concerned. The designers of swimming pools and the promoters who finance and maintain them very wisely take this into consideration.

A demand for information concerning the swimming pool in its relation to the public welfare caused the Conference of State Sanitary Engineers and the Engineering Section of the American Public Health Association to appoint a joint committee to study the subject. The report of this committee now forms the basis of recommendations in this field. The discussion which follows embraces the committee's report and the writer's personal observations.

Location of Pool.—A central location on a paved street and convenient to street car service should be selected. Ease with which connection can be made to a water and sewer system is an important consideration, and the ground on which the pool is built should permit good drainage and be of a dependable foundation.

Design of Pool.—Most pools are built rectangular, although a circular pool with deep water at the center may be more economical for large installations. Pools must be at least 60 ft. long and 20 ft. wide, with a minimum depth of 3 ft., according to the rule of the American Swimming Association in order for swimming records made in them to be official. However, the size of the pool usually depends upon the maximum probable attendance, the funds available, the size of the site, type of pool desired (fill-and-draw or recirculation), and the uses to be made of the pool, both special and general.

Some designers allow a capacity of 200 to 300 gal. per bather, while the joint committee, assuming that all bathers are not in the water all the time, recommends computing the pool capacity as follows:

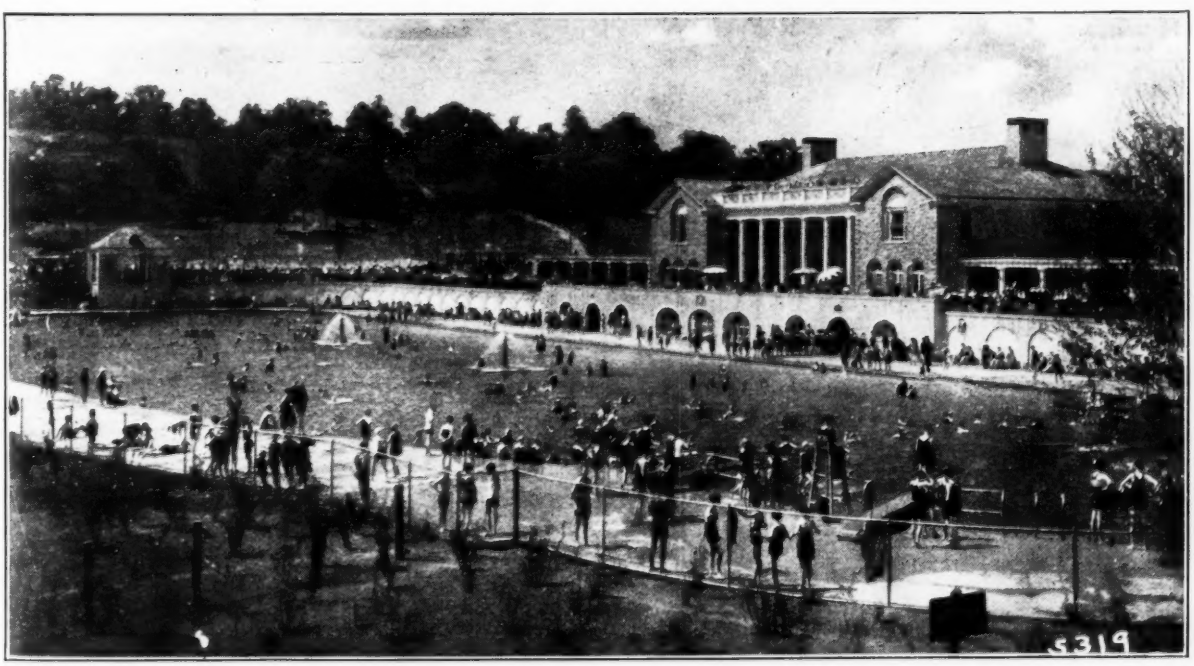
(1) Diving Zone—10-ft. radius of water, 7 to 10 ft. deep, for 12 divers.

(2) Swimming Zone—27 sq. ft. of water for each swimmer in water of 4½ to 7 ft. in depth.

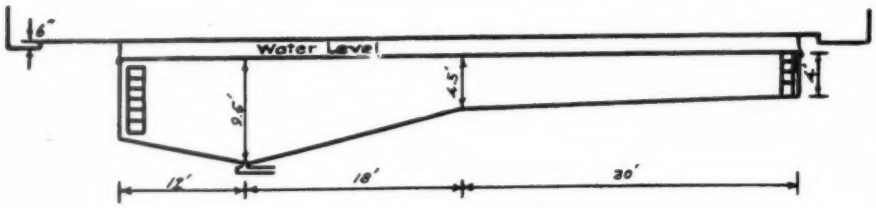
(3) Wading Zone—12 sq. ft. of water for each swimmer in water from 12 in. to 4½ ft. in depth.

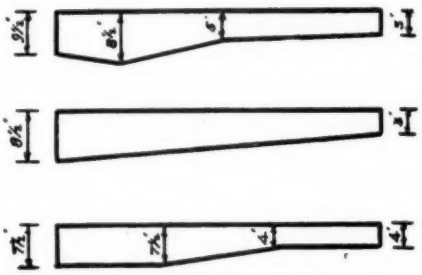
Fifty gallons of clean water having a chlorine residual of from .2 to .5 p.p.m. should be added for each bather.

If the flow through the pool is not continuous, the pool should be emptied and refilled after being used in the

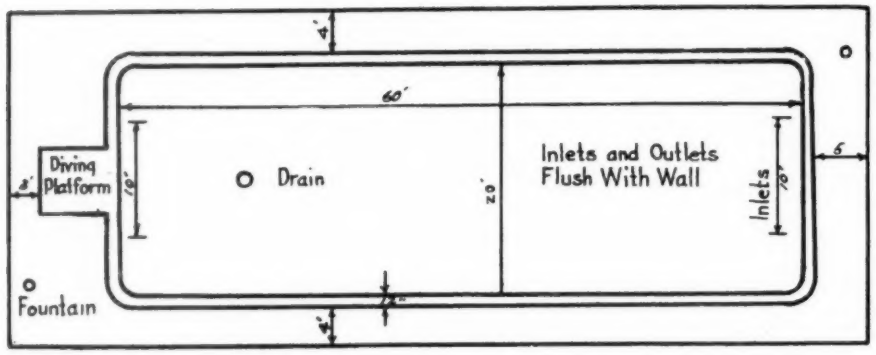


An Interesting Example of an Outdoor Swimming Pool

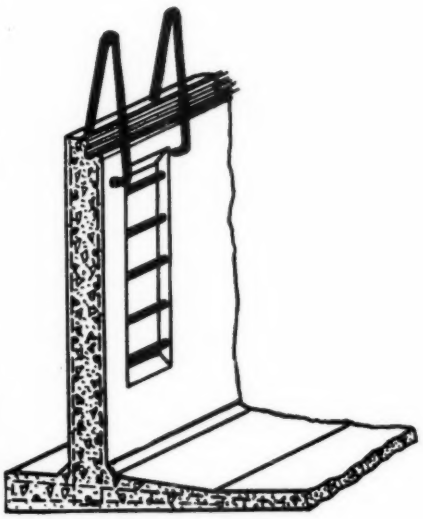




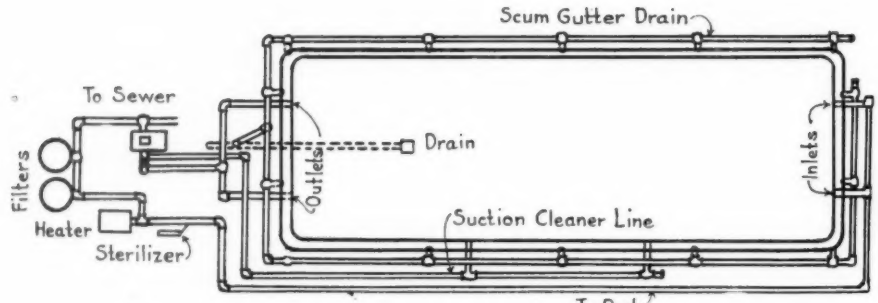
Pool Contours



Model Layout



Step Details



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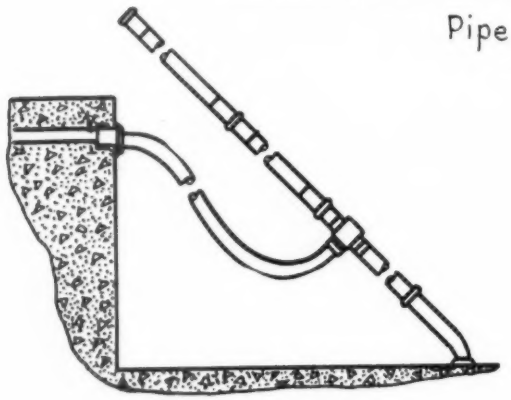
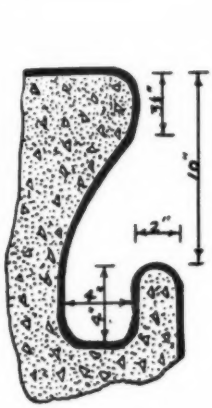
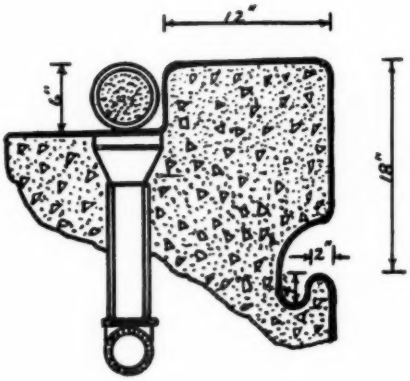
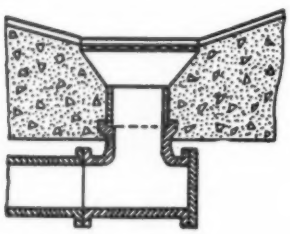


Suction Cleaner





Scum Gutters



Drain

Outlets and Inlets

Details of Swimming Pools Prepared by Division of Sanitary Engineering, State Department of Health of Texas

ratio of one bather for each 50 gal. of water. If disinfection is not continuous, the pool water must be disinfected after being used in the ratio of seven bathers for each 1,000 gal. of water.

It is apparent that these standards set by the committee indirectly taboo the "draw and fill" pool, and advocate the "continuous flow" or "recirculating" type for large installations.

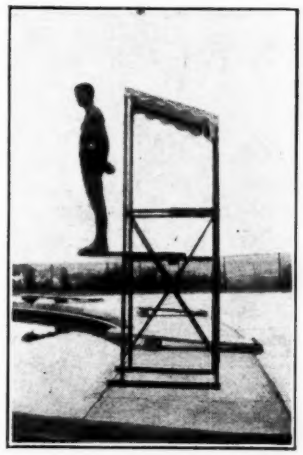
It is estimated that 80 per cent of the patrons stay in water that is less than 4½ ft. deep. Hence, from the standpoint of economy, 75 to 85 per cent of the pool should be designed for non-swimmers. Sudden changes in the depth of the pool should be avoided. A good slope in the shallow end is 1 ft. in 15. The siphon shaped bottom is commonly used in most rectangular pools. The bottom should be smooth, without rough joints or cracks, and the corners rounded. The lining of the bottom and sides should be white or light in color, preferably of tile or glazed bricks for indoor pools. White cement for outdoor pools is better than white paint. End and side walls should be vertical, and the depth of the water should be marked plainly on them. Indoor pools are frequently encased in a steel shell to afford double insurance against leakage.

Scum gutters should extend completely around the pool, recessed into the walls, and deep enough to prevent material from being washed into the pool by a splash or surge. Gutters should have a good slope with a drainage outlet every 10 ft. The edge of the gutter can profitably serve as a hand hold for bathers.

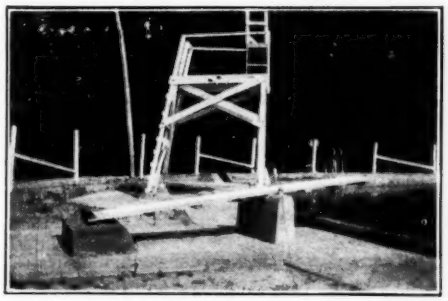
Piping.—The pipe system should be so arranged that water can be drained from the pool, either to the sewer or to recirculating pumps, and provision made against sewage backing up into the pool or drainage lines. The pipe system should include meters, blow-off valves, and valves for taking samples. Water should enter the pool at the shallow end and not more than one foot under the surface, preferably at 10-ft. intervals. There should be sufficient regulating devices to control the flow through the different inlets in order to insure uniform distribution of water throughout the entire pool.

Outlets are placed in the deeper section of the pool, spaced from 10 to 20 ft. apart, and covered with proper grating. Outlet openings should be larger than the discharge pipe in order to minimize suction. The outlet drain to the sewer is necessarily in the deepest point of the pool, and of such size as to permit emptying the pool in three hours.

Special Details of Construction.—Large pools should be built during the cooler seasons of the year. Proper allowance should be made for joint expansion. Floor slabs should not be cast monolithic with walls. Edges of the floor slabs should be provided with preformed, bitumastic expansion joints.



Elevated Chair for Life Guard



Diving Tower and Spring Board at Big Dipper Pool, Iowa City, Ia.

Wall footings may be poured continuous, or with expansion joints brought to a feather edge. If specifications for mixing concrete are rigidly followed, water proofing compounds are not needed to form a dense waterproof concrete. Walls should be poured in 50 or 60-ft. sections with suitable copper and preformed, bitumastic expansion joints.

Stairways should be recessed into the wall and runway of the pool. Steps inserted in the walls are less dangerous than projecting ladders.

Sidewalks and runways should be provided of non-slip finish, and 4 ft. wide (with a slope of ½ in. per foot) extending entirely around the pool. For indoor pools the drainage may go to the scum gutter, but for outdoor installations it is better to connect with the sewer. Desirable proportions for the raised edge of curb are 6 in. in height by 1 ft. in width. Although sand beaches and playgrounds contribute sediment to a pool, they are popular and increase the patronage. Much of the sediment may be kept out by erecting a fence between the pool walk and the sand beach, and this should be provided with a one-way turnstile to the beach walk and a return to the pool by way of the beach walk and through progressive showers and foot bath.

It is quite important that separate space be provided for spectators, and they should not be allowed on the runways or pool enclosure. Galleries should not overhang the pool.

Water Supply and Equipment Details.—For the larger outdoor pools, it is usually more economical to use the water again and again after removing impurities. The equipment required is commonly referred to as a recirculating system and includes pumps, hair catchers, filters, a chlorinator, and pipings to inlets and outlets.

The purification or recirculating system should have a capacity to permit treating the contents of the pool at least twice daily, and oftener where heavy bathing loads are anticipated. Motor driven centrifugal pumps are usually well adapted for recirculating systems.

A water heater is frequently a part of the system. Blowing steam directly into the pool, or the use of heating coils in the pool are both bad practice because of the dangers of burning. A better method is to use a heater for all or part of the return water. The average patron prefers water of a temperature ranging between 72 and 84° F. for swimming pools.

For indoor pools, pressure filters are generally used, while for large outdoor installations which use hard water, the gravity type of rapid sand filter may be more suitable.

The installation of a strainer with slotted openings 1/32 in. in diameter is recommended in order to prevent hair and lint from reaching the filters. The total area of strainer openings should be at least ten times the area of the water inlets.

Every pool should be provided with a suction cleaner. The cleaner may be operated by attachments to the suction of the pump used for recirculating the water. This operation is ordinarily done at night when the pool is emptied and the pump may be appropriated for that purpose.

Chlorine is at present the most acceptable disinfectant for swimming pool waters. Chlorine may be applied either as a gas or in water solution in the circulating water.

Good lighting increases the usefulness of the pool, adds to its attractiveness, and enables life guards to see all parts of the pool clearly. It is therefore essential. Observation towers for life guards should be placed at strategic points.

Sanitary drinking fountains are conveniences which are often times overlooked by the designer. A foot pool, or trough with shower at the entrance to the pool, is required if contamination of the pool water is to be kept down to a minimum.

Diving towers should be well braced, properly anchored, and rigidly constructed. In a public pool, no diving board or platform should be more than 10 ft. above the water level.

Bath Houses.—In the design of the bath house, due consideration should be given to heating, lighting, and ventilating facilities. Floors of all dressing and locker rooms should be of material

impervious to moisture and should have ample floor drains. All walls should be painted or otherwise finished with a waterproof coating.

When lockers are provided, they should be constructed vermin proof. At least one shower and one toilet should be provided for every forty bathers and, in addition, one urinal for every sixty male patrons.

Mechanical Agitators at Knoxville Water Works

Some Notes on the Operation of the New Installation

By W. W. MATHEWS
Of Alvord, Burdick & Howson, Consulting Engineers, Chicago, Ill.

KNOXVILLE, TENN., placed its new water works plant in operation Sept. 1, 1927. This comprises an intake, pumping station and filter plant and coagulation basins. In addition to the plant, two concrete reservoirs were added to the system, having capacities of 1,000,000 and 10,000,000 gal. respectively. Large feeder mains were also laid to strengthen the distribution system.

The Supply.—The source of water supply is the Tennessee River and the intake is located about three mils downstream from the junction of the French Broad and Holston Rivers.

Water from the French Broad River is soft, carrying colloidal clay and color caused by industrial wastes, most of which are organic. The water of the Holston River is hard and clear and is characterized by inorganic wastes, and of the two waters is the easier to clarify.

The ratio of discharge of the Holston to the French Broad River is approximately 3 to 5 and the intake is located on the Holston side of the Tennessee River. In general, the water at the plant is an average of the two waters, although at times one or the other predominates.

The combination of the two waters offers a water easier and more economical to treat than with either one separately. If French Broad water alone was treated, the alum dosage would have to be increased and lime used in combination with the alum. Color removal would require that the dosage be increased and lime would be necessary to counteract the free CO_2.

If Holston River water was treated alone, hardness would present the principal objection and part of this would have to be removed to make the water acceptable to industrial users. At present, one of the large industries located on the Holston River near Knoxville has a small filtration and softening plant, alum and soda ash being used. The deterioration of boiler tubes is presenting such a problem that a careful study is being made to correct the corrosive action of this water.

The water in the Tennessee River, as treated by the City of Knoxville, has presented no such problem.

Colloidal and organic impurities from the French Broad River require a somewhat larger chemical dosage at Knoxville than is required in most purification plants of this character.

The Mechanical Agitators.—After a careful study had been made of the water to be treated, which was available from records kept by the Knoxville Water Department, it was evident that a mixing device was required that would permit varying the period and violence of the mix on short notice. Mechanical agitators were chosen in that elasticity of operation could be effected with simplicity and ease of control.

The mechanical agitators consist of two circular reinforced concrete tanks 30 ft. in diameter and 20 ft. deep in which is placed the stirring mechanism. The mixing period is 20 minutes, using both tanks when the plant is operated at a 15,000,000 gal. rate. Piping to the tanks is arranged so that the tanks can be used singly, in parallel or in series. Raw water enters the tanks at the top and flows out through a 42-in. square opening in the floor of one tank, the opening being placed as near the center of the tank as the shaft supporting the mixing apparatus will permit. About one-third of the water surface in each tank is visible.

The Stirring Device.—The stirring device is on the same general plan as that used in installations of this character. A center shaft of 6-in. pipe carries a cross arm of 2½-in. pipe on which are suspended paddles. These paddles are of steel ⅛ in. thick and the area of the plates is slightly more than 25 per cent of a vertical diametrical section.

Power for operating the stirring device for each tank is from a 3 h.p., d.c. motor and speed variation in the motor is otbained by field control. This ranges from 650 to 1,950 r.p.m. A further reduction in speed is effected by a reducing gear and by a combination of chain and sprockets driving bevel gears. Specifications called for a variation in speed of from 4/10 to 1 and 3/10 r.p.m. of the mixing apparatus which is equivalent to 6/10 and 2 ft. per second peripheral velocity respectively.

Operating Experiences.—Experiments conducted at the plant show that when water from the French Broad River predominates in the Tennessee River, the best results are obtained by operating both tanks in series and with the stirring device rotating at 1 r.p.m. With the Holston River water being treated, a short rapid mix gives the best results. When the French Broad and Holston Rivers are at such a stage, the water is about evenly mixed, the tanks are operated in series, and the agitators operated at an average speed of 1 r.p.m.

Chemical feed piping is so arranged that alum or lime can be fed to either tank and so that lime can also be fed into the clear well. At times, it has been found advantageous to apply the alum ahead of the lime and at other times the best results have been obtained by applying the lime ahead of the alum.

The tanks are constructed so that if it is desired to reverse the direction of flow, through the tank, it can be effected easily. Operating experieence of the past six months shows that the present method of operation is satisfactory and no deposits have occurred in the tanks. Turbidity range is from 50 to 10,000 p.p.m. with an average throughout the year of 800 p.p.m.

Comparison of Chemical Costs.—Comparisons of chemical costs of the last quarter of 1927 operating the new plant with the last quarter of 1926 with the old plant in operation, show that there has been a saving in chemical costs of $1,700, plus treating water of similar character. A substantial saving in chemical costs was to be expected for the new water works supplants one of the oldest filter plants in the country, which has been operated under an overload for several years.

The cost of chemicals per million gallons for last quarter of 1926 and 1927 is listed below. This includes the cost of lime, alum, soda ash (used experimentally in 1926), ammonia and chlorine.

Chemical Cost Per Million Gallons

	1926*	1927**
October	$9.36	$6.96
November	9.31	5.47
December	7.57	4.53

Alum is used as a coagulant with lime being added at intervals as the character of the water requires. This is such a small percentage of the alum used that the table below showing grains per gallon used in the same periods listed above gives an idea of the reduction effected in chemicals by the mechanical mixers in the first three months of operation of the plant.

Alum Dosage in Grains Per Gallon

	1926*	1927**
October	3.34	2.26
November	3.43	2.07
December	2.89	1.72

All of the water works improvements were carired out under the direction of Col. Frederick W. Albert, Engineer in Charge of Water Department. Alvord, Burdick & Howson were Consulting Engineers for the City of Knoxville and the writer was Resident Engineer for the above firm.

Acknowledgment.—The foregoing is an abstract of a paper presented at the 1928 convention of the American Water Works Association.

*Old plant.
**New plant.

Diversions of Funds From Water Departments For Other Municipal Purposes

The Story of "Free Water" in Several American Cities

By HOWELL WRIGHT
Director, Department of Public Utilities, Cleveland, O.

THE study of this problem is worthy of the best efforts of the American Water Works Association. Its solution is vital to the continued operation of the water works as an active self sustaining business or public utility, as well as the efficient operation of other municipal departments. The absolute necessity for such a solution is father to the fact that the problem can be solved. If this association, which is the largest representative of the water works interests in this country, is aroused to energetic action and to the extent of taking the initiative in forming uniform plans for the abatement and final elimination of the diversion of water works funds for other purposes, then this paper will not have been written in vain.

Atlanta, Ga.—The water works department of Atlanta, Ga., is operated in general as though it were a tax supported department. All revenue is placed in the general fund and all moneys for operation and maintenance or extensions and enlargements are appropriated either directly or indirectly from this fund. Water is furnished free for fire protection, public schools, parks, public buildings, cemeteries, street sprinkling, hospitals and all city institutions. It is not furnished free for parochial schools.

Baltimore, Md.—Water rents are diverted into the general revenues of the city but loan funds are not. Appropriations are made annually for the water bureau for operation and fixed charges. Deficits, if any, are made from the tax levy and any surplus is diverted into the general revenue. The city pays for a part of the water it uses for park purposes. Water, however, is furnished free for public schools, fire protection, public buildings and street sprinkling. Parochial schools and cemeteries pay for all the water they use.

About $450,000 or about 13 per cent of the total annual revenue is diverted from water works funds in the form of free services. The Water Bureau pays no taxes nor does it pay its share toward the upkeep of other city departments which may render it service.

Boston, Mass.—Water is furnished to Boston by the Metropolitan District Commission. The city does not pay the commission for any water used for public schools, fire protection, parks, public buildings, nor street sprinkling. Water is not furnished free to parochial schools nor cemeteries. The quantity of water furnished free is about 1 per cent of the total used in Boston. The commission does not pay anything towards the upkeep of city departments which may render it service and is entitled to receive moneys out of taxes in case of deficit growing out of operation and maintenance.

Buffalo, N. Y.—Aside from a small quantity of water furnished free to the State Teachers College and State Hospital for the Insane, there is practically no diversion of funds of any character, the approximate annual cost to the water division for all free services not exceeding $5,000. This is less than 0.2 of 1 per cent of the total revenue. The water division does not pay any money toward the upkeep of any other city department which may render it service.

Charleston, S. C.—The water department of the city of Charleston, S. C., is administered independent of the city council under state law. The commission handles all of its own funds acting as its own sinking fund commissioners. The law provides that the interest on bonds for original purchase or construction and sinking fund for retirement of these bonds shall be taken care of by assessment in the general tax levy if necessary. All fire hydrants and all water up to 300,000 gal. a day are paid for. There are times when water in excess of this quantity is used and for such excess the water works has never been paid. Usually the diversion of funds represented by this excess is small. The water commission has voluntarily contributed a portion of the surplus funds to the general sinking fund. The maximum amount thus contributed in any one year has been $40,000.

Chicago, Ill.—Chicago does not permit direct diversion of water works funds. The water department does, however, furnish water free of charge for public and parochial schools, fire protection, parks, street sprinkling and public buildings. It receives no money from taxes, but pays its share toward the upkeep of city tax supported departments which render it service. There were diverted from the water works funds in 1927 through free service, nearly $2,125,000 or about 16½ per cent of its total revenue.

Cleveland, O.—The water works of the city of Cleveland, during the year 1926, furnished to the city and suburbs a total of 8,245,365,000 cu. ft. of filtered water. Of this quantity, there were approximately 430,000,000 cu. ft. for which the water division received absolutely no pay. If this division had been paid for its product at the present rate of 60 ct. per 1,000 cu. ft., it would have added to its annual revenue approximately $260,000. This diversion from the funds of the water division is made up of non-metered water furnished free of cost to the tax supported city departments for fire protection, street cleaning, sewer flushing, and for use in parks and play grounds and metered water furnished free to public schools, parochial schools, public buildings, city cemeteries, city markets, public libraries and charitable institutions.

The amount of non-metered water used for fire protection, street cleaning, sewer flushing and for parks and play grounds cannot be estimated with any degree of accuracy. The tendency, however, has been to err on the side of conservatism and, to that extent, the diversion of funds is understated. The amount involved however, is probably a comparatively small percentage of the total and cannot therefore affect any conclusions reached. On the basis of the quantity of water estimated, the annual loss to the water division for water furnished for the foregoing city functions, all of which are in connection with some tax-supported department, is approximately $40,000.

Public Schools.—While it has been necessary to resort to estimation in our analysis of certain previously mentioned factors involved in this discussion of the Cleveland situation, the expediency has been avoided in the case of public and parochial schools, hospitals, charitable institutions, public buildings and cemeteries. These consumers are all metered and the amount of the diversion of funds in these particular cases is within the limit of accuracy of the measuring devices used. Those amounts bulk large in total and the legislative body (state and city) was the medium through which most of the diversion takes place. The governing body of the city provided in 1909 "Rules and Regulations" for the use of water. Rule 5 of these regulations stipulates that:

"Water shall be furnished free for

market houses, public school buildings, and other public buildings belonging to the city, and all hospitals, asylums, and other charitable institutions devoted to the relief of the poor, the aged, infirm or destitute persons, or orphan children, upon the following conditions:

The following average daily per capita allowance of free water, based on the average number of inmates and attendants, shall be granted as a maximum free of charge to such institutions, to-wit:

Public schools, 15 gal. per capita, for the average attendance per day during such days as schools are in session.....

.....

All such institutions as enumerated in the foregoing shall pay for all water used or that passes through the meters supplying said institutions, etc., at the City meter rate, for all consumption above the maximum."

While these regulations unquestionably permit the use of free water for the public schools the natural inference would be that if the public schools used more than 15 gal. per capita per day that they would have to pay the water division for all in excess of that maximum. As a matter of fact, however, no such payments have ever been made, although this excess amounted to over 188 per cent in 1924, over 184 per cent in 1925 and nearly 216 per cent in 1926. Until recently it was held that "under the law, boards of education cannot be compelled to pay for water." The supreme court of the state of Ohio has just decided by a majority vote that they can be made to pay. Unfortunately for the Cleveland Water Division, there are certain peculiarities in connection with Ohio law and it is not yet definitely known that this decision is yet enforceable in this district.

During the year 1926, the total value of the water furnished free to the public schools amounted to $105,538.90. The value of the water furnished during the same year in excess even of that allowed by the Council ordinance of 1909 was $72,138.56.

Parochial and Private Schools.—Free water is furnished to parochial and private schools up to the same maximum of 15 gal. per capita per day as is allowed to public schools. Under this regulation, water was furnished free at water works expense during 1926, to the value of $8,614.70.

Charitable Institutions and Hospitals.—Rules and regulations provide that all charitable institutions and hospitals are entitled to free water up to a maximum of 40 gal. per capita per day, for the former and 75, for the latter. In accordance with this stipulation, the water division lost, during 1926, a total revenue of $56,407.60, of which $39,906.80 went to hospitals and the remainder to charitable institutions.

City Markets, Cemeteries and Golf Courses.—City markets, cemeteries and golf courses are supposedly self-sustaining divisions connected with tax-supported departments, yet they pay not one cent for water. There was diverted from water works funds during 1926 to furnish these divisions with free water a total of $5,947.80, of which $4,266 was for the markets, $1,630.80 for the cemeteries, and $51.00 for golf courses.

Private Cemeteries.—There are a total of 16 private cemeteries in the Cleveland district. Of these sixteen, four are furnished with water free of cost. Water to the value of $6,256.10 was furnished these cemeteries during 1926. With the exception of one, no authorization by council has apparently ever been made for this practice. In the case of this exception, the city council in 1895 passed a resolution exchanging "free water in perpetuity for a certain strip of land to be used for street purposes." Since this contract, the water division has furnished free water costing $38,410.90 and the demand for water is steadily increasing.

Public Buildings.—The amounts of money which may be diverted from water works funds in the form of free water for public buildings, such as police stations, jails, workhouses, fire engine houses, etc., is limited only by the needs of the institutions. The celebrated Rule 5 previously mentioned, states that water shal be furnished free of charge to "Police Stations and Jails, Work Houses, Fire Engine Houses, Market Houses, Public Bath Houses and other public buildings 'up to a maximum' as may be estimated by the superintendent of the water department." Under this rule, 35 police stations, 21 fire stations and 16 libraries were furnished during 1926 with water, having a value of $30,280.12. The city hall bill should have been $1,791 during the same period, while that for the market houses is, as previously noted, $4,266.

It should not be considered that the figures given in the preceding paragraphs are unusual. In 1924, the total value of metered free water was $197,228.60 and in 1925, $200,072.50, as compared with $214,787.20 in 1926.

The water division itself pays for everything it receives. It contributes its share toward other City Departments whose services it uses, such as law, civil service, etc. It also pays rent for the use of its quarters in the city hall. All services of all tax-supported departments are paid. If the department of public service repairs the street or sidewalk after a break or after the installation of water main or service connection, the water division pays the entire cost. If the park lawn or shrubs are disturbed by a water main trench, the entire expense of replacement is borne by the water division. The water division itself receives no tax money. There is thus seen to be no compensatory services for that which it furnishes. The free services of this division represent an unqualified diversion of water works funds, a diversion which is not justifiable in logic, in business or in law. The value of this diversion at Cleveland is approximately 5 per cent of the total revenue received.

An ordinance, however, has just been introduced in the city council for the purpose of correcting the present policy of free water. If enacted, this ordinance will place Cleveland in the ranks of the most progressive cities, in that all water furnished will be revenue producing.

Denver, Col.—Direct diversion of water works funds is not permitted in this city and practically no water is furnished free, the city paying for what it uses and in addition paying an annual fire hydrant rental of $22.50 per hydrant. The water works, however, does work for tax supported departments for which it is not paid, such as relaying and lowering water mains and fire hydrants in improvement districts. In 1927 this amounted to over $38,000 which in connection with a small amount for other free services is about 2 per cent of its annual revenue. The water works receives no money from taxes.

Louisville, Ky.—There is no direct diversion of water works funds in Louisville, but water is furnished free to city departments. This includes water for fire protection, parks, public buildings, street sprinkling and public schools. Parochial schools and cemeteries pay for all water used. The water works is operated by a board appointed by the mayor. No taxes are paid nor does the water works receive any tax money. There is no record of the cost of free service furnished.

Milwaukee, Wis.—No diversion of water works funds is permitted in Milwaukee except that approximately $300,000 is transferred annually to the general fund in lieu of taxes. This $300,000 is approximately 12½ per cent of the total revenue of the water department. The city pays for all water used for all purposes. The water department does not receive any money from taxes nor does it pay for any service rendered it by tax-supported departments such as law, civil service, etc.

Philadelphia, Penn.—The entire income from the water works of this city is placed in the general fund from which appropriations are made for any purpose desired by the city council. The city does not pay for any water it uses, free water being furnished for public schools, fire protection, parks, public buildings and street sprinkling. Parochial schools and charitable institutions pay for what water they use at a special rate. The water works does not receive any tax money but any deficit would be taken out of the general fund.

Pittsburgh, Penn.—All revenue received from the sale of water in Pittsburgh, Penn., is placed in the general city fund and the council may appropriate it for any purpose it sees fit. The city does not pay for any water it uses but

water is furnished free to all city departments, to public and parochial schools; for fire protection, parks, public buildings, cemeteries and street sprinkling. Any operating or maintenance deficit is made up from the general fund. The department is operated as though it were tax supported.

Portland, Ore.—Direct diversion of water works funds is not permitted but indirect diversion is practiced in the furnishing of free water for city buildings, parks, street sprinkling and fire protection. Public and parochial schools and cemeteries pay for all water used. There are no publicly owned cemeteries. The water department receives no money from taxes nor does it pay any taxes directly. It pays a rental charge for city hall space, but nothing towards its share of the services of auditor, treasurer, attorney, etc. It is considered that part of the free water to the extent of about $75,000 is an offset against taxes. On this asumption the water works funds are being diverted to the extent of approximately $100,000 per year.

St. Louis, Mo.—The water works of the city of St. Louis does not permit the direct diversion of water works funds. The department does not furnish free water for public schools, parochial schools nor cemeteries. It does, however, furnish it free for fire protection, parks, public buildings and street sprinkling. It pays nothing toward the upkeep of other city departments which render it service. It receives no money from taxes.

San Francisco, Cal.—While the water works of this city is not yet operated as a municipal project, it is proposed that it be controlled by a public utilities commission. If this proposal is accepted in an election to be held August 28th, the use of water works funds will be restricted to water works purposes. The water works will pay for everything it receives and the city will pay for all water and all water works services it may use.

Washington, D. C.—No direct diversion of water works funds is permitted in Washington, D. C., but indirect diversion is practiced in the form of free water to the extent of about 50 per cent of the annual revenue. Water is furnished free of charge for public schools, parochial schools, fire protection, parks, public buildings, cemeteries and street sprinkling. The water works receives no money from taxes nor does it pay any. Neither does it pay anything for such services as law, treasury, civil service, etc.

Conclusions.—It takes but a simple perusal of the foregoing description of how the water works business is being handled in some of the representative cities of the United States to realize the practical chaos that exists. Diversion in some form or other is practiced almost universally. The entire water works situation, today, is in a state of flux, the older tendency being to divert funds at will, at least in the form of service, while the newer, attempts to prevent diversions of any and all kinds. This indeterminate position of publicly owned water works is a detriment to efficient management. It absolutely prevents any just comparison of costs and lays the business open to abuses of many kinds. This is the situation. What is the remedy?

There are but two possible answers to the question. Either publicly owned water works must become tax supported and tax maintained municipal departments or they must function absolutely as publicly owned utility enterprises. The first answer is really no answer at all, for a water works whether publicly or privately owned is basically "..... a commercial enterprise. It serves a limited number of persons ..... it is unlike the city hall in that it does not, or may not, give actual or potential service alike to all the people ....." (Raymond's "The Public and Its Utilities.") The water works cannot therefore function as a tax supported department; it is founded on an entirely different principle. The ability to pay taxes and the desire or capacity to use water meet on no common ground.

This leaves no alternative but the operation of the water works as a publicly owned utility and it cannot be so operated unless it functions as such in its entirety. It not only must render pay for every service it receives, but it must be paid for every service it renders. This eliminates any gifts of taxation but demands pay for all of the product it furnishes. Raymond in his book "The Public and Its Utilities," in the chapter on Texas, reaches this conclusion:

"It is concluded, therefore, with respect to a public utility property, that whether the property be under public or private ownership, it should be assessed and pay taxes as other property and should collect these taxes in turn as a cost of service from those whom it serves; and it is concluded further that if in general it be deemed public policy for any reason not to assess a public utility property when owned by the public, it should be equally the public policy to exempt public utility property from taxation when under private ownership." He also states in his same book under the title of General Considerations in the chapter on Rate Making for Water Service. "It is a cardinal principle, now recognized by courts and commissions, that users of service, either public or private users, should pay for the service in proportion to the costs they entail, and the value of the service rendered; that public service such as fire protection service, sewer flushing, street, park and public building service, should be paid for by the city, and collected in the general tax. It is assumed that such service is for all the people, and that the most equitable way of securing its cost is by assessment in taxes, which may be supposed to distribute the cost somewhat in proportion to the value of the service ..... The principle announced in the first sentence ..... has not been observed generally in the past, and is not observed generally at the present time, although more and more it is being recognized and applied. In many cities owning their own plants, and in some in which the plant is under private ownership, public service is free. This is held to be unfair and of doubtful legality, since it imposes on the private consumers a charge that is properly a public expense chargeable to all tax payers. The free srvice is the enforced gift of the private consumers." This last sentence contains the crux of the entire situation. The fallacy of "free water" is based not on the principle of justice but embodies the doctrine of force. Embodying this doctrine, it contains the seed of elemental destruction. Either free water must be eliminated from water works practice or efficient water works management must go down in failure, with its corresponding effect upon municipal government.

Acknowledgment.—The above is an abstract of a paper presented at the 48th Annual Convention of the American Water Works Association.

Missouri Sewer District Act Held Constitutional

Public Health Reports for June 1, cites the following decision of the Missouri Supreme Court on the validity of the state law for the formation of sewer districts:

"(Missouri Supreme Court; State ex rel. Gentry, Atty. Gen. v. Curtis et al., Sup'rs of Webster Groves General Sewer Dist. No. 1 of St. Louis County, 4 S. W. (2d) 467; decided March 17, 1928.) An act approved March 25, 1927 (Missouri Laws 1927, pp. 439-465), authorized the formation of sewer districts in counties having 75,000 or more population. A quo warranto proceeding was brought to oust certain persons as supervisors of a sewer district, it being contended that the above-mentioned act, under which the supervisors held office, was unconstitutional. Numerous grounds of unconstitutionality were urged but the supreme court ruled against them all, thus holding the law to be a valid enactment."

Booklet on Safe Flying.—"Safety—The First Essential for Progress in Air Transport," is the title of a new booklet just issued by the National Safety Council, Chicago. It contains a foreword by Homer E. Niesz, president of the institution, and an article by Harry F. Guggenheim, president, The Daniel Guggenheim Fund for Aeronautics.

Financing the Operation of Sewage Treatment Plants

Ohio Plan Places Sewerage on Utility Basis

IN 1923 the legislature of the state of Ohio passed a law to provide special revenues for sewerage departments. This statute is known locally as the sewer rental law. Its purpose is to permit municipalities to assess and to collect charges for the use of sewers and to provide for the proper maintenance, operation and control of sewer systems and sewage disposal works. The law is intended to place the sewerage departments of a municipality upon much the same basis as the water department is placed In other words sewerage department will be operated as a utility and placed upon a self-supporting basis by equitable charges for sewerage and sewage disposal service. The state law providing for this is as follows:

SEWER RENTAL LAW

[Section numbers, Ohio General Code. Effective July 30, 1923.]

Sec. 3891-1. The council of any city or village which has installed or is installing sewerage, a system of sewerage, sewage pumping works or sewage treatment or disposal works for public use, may by ordinance establish just and equitable rates or charges of rents to be paid to such city or village for the use of such sewerage, a system of sewerage, sewage pumping works or sewage treatment or disposal works by every person, firm or corporation whose premises are served by a connection to such sewerage, system of sewerage, sewage pumping works or sewage treatment or disposal works. Such charges shall constitute a lien upon the property served by such connection and if not paid when due shall be collected in the same manner as other city and village taxes. The council may change such rates or charges from time to time as may be deemed advisable. Provided, however, that in a municipality operating under a municipal charter the council or other legislative body may establish the schedule of rates herein authorized and provide for its administration by designating the department or officer of the municipality to be charged with the enforcement of the provisions of this act. [110 v. 370.]

Sec. 3891-2. In a city the director of public service shall manage, conduct and control the sewerage system and sewage pumping, treatment and disposal works and when the council has established a schedule of rates or charges of rents for their use shall collect sewer rentals, and he shall appoint the necessary officers and agents for such purposes. [110 v. 370.]

Sec. 3891-3. When the council of a village has established a schedule of rates or charges of rents for the use of the sewerage system and sewage pumping, treatment and disposal works, the board of trustees of public affairs shall manage, conduct and control such sewerage system and sewage pumping, treatment and disposal works and shall collect sewer rentals and shall appoint necessary officers and agents for such purposes; and shall assume all duties, in relation to sewers, imposed upon the street commissioner by Section 4364 of the General Code, whereupon the street commissioner shall be relieved of such duties. [110 v. 370.]

Sec. 3891-4. The director of public service and the board of trustees of public affairs may make such by-laws and regulations as may be deemed necessary for the safe, economical and efficient management and protection of the sewerage system and sewage pumping treatment and disposal works; and for the construction and use of house sewers and connections to the sewerage system. Such by-laws and regulations shall have the same force and effect as ordinances when not repugnant thereto or to the constitution or laws of the state. [110 v. 370.]

Sec. 3891-5. The funds received from the collection of sewer rentals shall be deposited weekly with the treasurer of the corporation. Money so deposited shall be kept as a separate and distinct fund and shall be known as the sewer fund. When appropriated by council, it shall be subject to the order of the director of public service of a city or board of trustees of public affairs of a village. Such director or board shall sign all orders drawn on the treasurer of the corporation against such fund. This fund shall be used for the payment of the cost of the management, maintenance, operation and repair of the sewerage system and sewage pumping, treatment and disposal works and any surplus in such fund may be used for the enlargement or replacement of the same and for the payment of the interest on any debt incurred for the construction of such sewerage system and sewage pumping, treatment and disposal works, and for the creation of a sinking fund for the payment of such debt, but shall not be used for the extension of a sewerage system to serve unsewered areas or for any other purpose whatsoever. [110 v. 370.]

Sec. 4357. In each village in which water works, an electric light plant, artificial or natural gas plant, or other similar public utility is situated, or when the council orders water works, an electric light plant, natural or artificial gas plant, or other similar public utility, to be constructed, or to be leased or purchased from any individual, company or corporation, or when the council shall have determined to establish a schedule of rates or charges of rents for use of the sewerage system and sewage pumping, treatment and disposal works of the village, council shall establish at such time a board of trustees of public affairs for the village, which shall consist of three members, residents of the village, who shall be each elected for a term of two years. [110 v. 370.]

Several municipalities in Ohio have taken advantage of the sewer rental law and have passed ordinances fixing charges for sewer service which will make possible the proper financing of their sewage treatment works. The revenue required in the case of the ordinary village or small city may easily be secured from a flat rate charge and it appears that about $4 to $5 per year per house connection will bring in enough money to take care of the operation charges. Some municipalities have determined upon a graduated scale of charges based upon the water consumption as a measure of sewage flow. In those instances where industries may be provided with private water supplies, estimates of sanitary and industrial sewage may be made.

We are reprinting below the ordinances adopted by three Ohio cities.

DELAWARE, OHIO
SEWER RENTAL ORDINANCE
NO. 1125.

To provide funds for the Maintenance, Operation and Control of the Sewerage System and Sewage Treatment Works of the City of Delaware, Ohio.

Whereas, The City of Delaware, Ohio, has installed a Sewerage System and Sewage Treatment Works, and

Whereas, It is necessary for the preservation of the public health and for compliance with orders of the State Department of Health, that said sewerage system and sewage treatment works be properly maintained, operated and controlled, and

Whereas, Funds for the maintenance, operation and control of said sewerage system and sewage treatment works will not be available from the current operating revenue of the City, and

Whereas, The General Assembly of the State of Ohio has enacted a law, amending Section 4357 of the General Code, to permit municipalities to assess and collect for the use of sewers, said charges to provide for the proper maintenance, operation and control of sewerage systems and sewage treatment or disposal works,

Now, Therefore, Be it Ordained by the Council of the City of Delaware, State of Ohio:

Section 1. That the Director of Public Service be and he is hereby authorized and directed to manage and control the sewerage system and sewage treatment works in a safe, economical and efficient manner.

Section 2. That the Director of Public Service be and he is hereby authorized and directed to make such by-laws and regulations as may be deemed necessary for the safe, economical and efficient management and protection of the sewerage system and sewage treatment works, and for the construction and use of house sewers and connections to the sewerage system; that such by-laws and regulations shall have the same force and effect as ordinances when not repugnant thereto nor to the constitution or laws of the State of Ohio.

Section 3. That the terms and conditions upon which the owners of lots and lands within the corporate limits of the City of Delaware, may connect to the sewerage system either directly or indirectly, shall be as follows:

Article 1. Charges shall be paid at the office of the Director of Public Service, and for each calendar year or part thereof they shall be in accordance with the following schedule of rates:

Dwellings and Apartments
- One-Family (one connection) $4.00 per annum.
- Two-Family (one connection) $7.50 per annum.
- Two-Family (two connections) $8.00 per annum.
- Four-Family (two connections) $15.00 per annum.
- Others (for each family) $4.00 per annum.
- For each additional family on the same connection $3.75 per annum.

Hotels
- For each room with bath $1.75 per annum.
- For each room without bath $1.00 per annum.

Rooming Houses and Fraternities
- Four Dollars ($4.00) per annum plus One Dollar ($1.00) per annum for each person renting a room therein.

Stores, Resturants, Offices and Mercantile Establishments
- Private Toilets, each $4.00 per annum.
- Public Toilets, each $8.00 per annum.
- Kitchen Sinks, each $4.00 per annum.
- Slop Sinks, each $2.00 per annum.

Factories and Shops
- For each and every person employed or engaged in services on the premises, in accordance with the following schedule:
- Ten persons or less, each $2.00 per annum.
- More than 10 and not over 25, 90 cents per annum.
- More than 25 and not over 50, 80 cents per annum.
- More than 50 and not over 100, 70 cents per annum.
- All over 100, 60 cents per annum.

Churches
- For each toilet $2.00 per annum.

Colleges
- All college buildings and dormitories not subject to taxation shall be grouped and the sewer rental fixed on a per capita student population:
- For each registered student 75 cents per annum.

Hospitals and Sanitariums
- Delaware Springs Sanitarium $100.00 per annum.
- Jane M. Case Hospital $60.00 per annum.

Miscellaneous
- For special cases which are not clearly defined in the above schedule, rates shall be established by Council upon the recommendation of the Director of Public Service.

Article 2. Charges shall become due and payable in advance on the first day of January, April, July and October. All bills not paid by the fifteenth of the month in which same becomes due shall be subject to a 10 per cent penalty.

Article 3. Charges shall constitute a lien upon the property served by such connections, and if not paid within ninety days, shall be collected in the same manner as other city taxes.

Article 4. Charges for discharging industrial wastes into the sewerage system shall be fixed by the Director of Public Service and approved by Council.

Section 4. That the funds received from the use of sewers shall be deposited with the Treasurer of the City, and money so deposited shall be kept in a separate and distinct fund and shall be known as the SEWER RENTAL FUND. When appropriated by Council it shall be subject to the order of the Director of Public Service and said Director shall sign all orders drawn on the Treasurer of the City against said fund.

Section 5. Funds received from the use of sewers shall be used for the payment of the costs and expenses of the management, maintenance, operation and repair of the sewerage system and sewage treatment works, and any surplus in such fund shall be used for the enlargement or replacement of the same or for the payment of the interest on any debt incurred for the construction of such sewerage system and sewage treatment works, or for the creation of a sinking fund for the payment of such debt, but shall not be used for the extension of the sewerage system to serve unsewered areas nor for any other purpose whatsoever.

Section 6. That this ordinance constitutes a part of an emergency measure and shall take effect and be in force from and after its passage.

Passed August 1, 1927.
Attest: F. D. King, Clerk.
Attest: H. C. Kent, President of Council.
Approved: H. D. House, Solicitor.
Approved: August 1, 1927.
C. L. Owen, Mayor.

EXHIBIT 4
OXFORD, OHIO.
SEWER RENTAL ORDINANCE
NO. 23.

An ordinance establishing the rates or rents to be paid to the Village of Oxford, Ohio, for the use of the sewerage system and the sewage treatment and disposal works by every person, firm, corporation or institution whose premises are concerned in connection with such system of sewerage and sewage treatment and disposal works.

Be it ordained by the Council of the Village of Oxford, Ohio.

Sec. 1. That there be and is hereby established the rents or charges to be paid the Village of Oxford, Ohio, for the use of the sewerage system and the sewage treatment and disposal works by every person, firm, corporation or institution whose premises are served by a connection to such sewerage system and sewage treatment and disposal works as follows: A rental equal to Twenty-Five (25c) cents per 1,000 cubic feet of water consumed per quarter year, with a minimum charge of $1.25 per quarter year for each sewer service connection from each premise to the sewerage system.

Said rents and charges are to become effective on the 2nd day of January, 1925, and the same are due and payable in April, July, October and January of each year, the first rental charges and rates being due in the month of April, 1925, and payable by the 15th day of the month wherein the same become due.

Sec 2. Said rents or charges shall be collected and placed in a separate sewer fund and dispersed in the manner provided by law.

Sec. 3. This orinance shall take effect and be in force from and after January, 1925, or the earliest period allowed by law.

Passed December 2nd, 1924.
Attest: Retta Hunsinger, Clerk.
(Signed) E. E. Powell, President.

DAYTON, OHIO.
SEWER RENTAL ORDINANCE
No. 13448.*

Fixing the Rates to be Charged by the City of Dayton, Ohio, to the Owners of Benefited Property for the Use of Its Sanitary Sewerage System, or parts thereof, including the Sewage Pumping and Treatment Works.

Whereas, The City of Dayton has built and has in operation a sanitary sewerage system for the purpose of collecting sanitary sewage and conveying the same away from the premises where produced to a place of disposal, and is constructing intercepting sewers, pumping stations, force mains and a disposal works for the treatment of such sewage; and

Whereas, The City Commission finds, in order to promote the public health, safety, welfare and convenience, that a system of sanitary sewerage, including intercepting sewers and force mains, sewage pumping works and a sewage treatment works, are necessary, and that in order to pay the cost of the management, maintenance, operation and repair, or for the enlargement and replacement of the sanitary sewerage system and the sewage pumping, treatment and disposal works and to pay the interest upon the bonds issued and outstanding and to be issued to provide funds for the construction thereof and to retire said bonds as they mature, it is necessary to levy and collect a charge of rental upon the lots, lands and premises served by sewerage connection with the sanitary sewer system of said City; therefore,

Be It Ordained by the Commission of the City of Dayton:

Section 1. It is hereby determined and declared to be necessary and conducive to the protection of the public health, safety, welfare and convenience of the City of Dayton, Ohio, to levy and collect charges or rentals upon all lots, lands and premises served by having connections with the sanitary sewerage system and by the sewage, pumping, treatment and disposal works of said City, the proceeds of such charges or rentals so derived to be for the use of the sanitary sewerage system and the pumping, treatment and disposal works of said city, as hereinafter provided.

Section 2. For the purposes of this ordinance the terms "Sanitary Sewage" and "Industrial Wastes" are defined as follows:

(a) "Sanitary Sewage" is hereby defined as the waste from water closets, urinals, lavatories, sinks, bath tubs, showers, household laundries, cellar floor drains, garage floor drains, bars, soda fountains, cuspidors, refrigerator drips, drinking fountains and stable floor drains.

(b) "Industrial Wastes" are hereby defined as being the liquid waste resulting from any commercial, manufacturing or industrial operations or processes.

Section 3. For the purposes as provided in Sections 1 and 8 hereof there is hereby levied and assessed upon each lot, parcel of land, building or premises having any sewer connection with the sanitary sewerage system of said city or otherwise discharging sewage, industrial wastes, water or other liquids, either directly or indirectly into the City sanitary sewerage system, a sewerage service charge or rental payable as hereinafter provided, and in amount determinable as follows:

(a) For any lot, parcel of land, building or premises, situated within the corporate limits of the City of Dayton, Ohio, and having any connection with the city sewerage system or otherwise discharging sanitary sewage, industrial wastes, water or other liquids, either directly or indirectly, into the City sanitary sewerage system, said charge or rental shall be based upon the quantity of water used thereon or therein as the same is measured by the City water meter there in use, and there shall be charged: for the first 3,000 cubic feet of water, or part thereof, so used per quarter year, the sum of One Dollar ($1.00); for each thousand cubic feet of water used in excess of 3,000 cubic feet and not exceeding 10,000 cubic feet, per quarter year, at the rate of Thirty Cents (30c) per 1,000 cubic feet; for each thousand cubic feet of water in excess of 10,000 cubic feet and not in excess of 20,000 cubic feet, per quarter year, at the rate of Twenty-five Cents (25c) per 1,000 cubic feet; for each thousand cubic feet of water in excess of 20,000 cubic feet and not in excess of 100,000 cubic feet, per quarter year, at the rate of Twenty Cents (20c) per 1,000 cubic feet; for each thousand cubic feet in excess of 100,000 cubic feet and not in excess of 500,000 cubic feet per quarter, at the rate of Fifteen Cents (15c) per one thousand cubic feet; for each thousand cubic feet in excess of 500,000 cubic feet per quarter at the rate of Ten Cents (10c) per 1,000 cubic feet; provided, that the minimum charge shall be One Dollar ($1.00) per quarter year or part thereof.

(b) For any lot, parcel of land, building or premises situated outside of the corporate limits of the City of Dayton, Ohio, and having any connection with the City sanitary sewerage system or otherwise discharging sanitary sewage, industrial wastes, water, or other liquids, either directly or indirectly, into the City sanitary sewerage system, said charge shall be based upon the quantity of water used thereon or therein as the same is measured by a water meter there in use which meter shall be to the approval of the Director of Water, and there shall be charged for the first 3,000 cubic feet of water, or part thereof, so used per quarter year, the sum of One Dollar and Twenty-five Cents ($1.25); for each thousand cubic feet of water used in excess of 3,000 cubic feet and not exceeding 10,000 cubic feet, per quarter year, at the rate of Thirty-eight Cents (38c) per thousand cubic feet; for each thousand cubic feet of water in excess of 10,000 cubic feet and not exceeding 20,000 cubic feet per quarter year at the rate of Thirty-one Cents (31c) per thousand cubic feet; for each thousand cubic feet of water in excess of 20,000 cubic feet and not exceeding 100,000 cubic feet per quarter at the rate of Twenty-five Cents (25c) per thousand cubic feet; for each thousand cubic feet in excess of 100,000 cubic feet and not in excess of 500,000 cubic feet per quarter, at the rate of Nineteen Cents (19c) per thousand cubic feet; for each thousand cubic feet in excess of 500,000 cubic feet per quarter at the rate of Thirteen Cents (13c) per thousand cubic feet; provided that the minimum charge shall be One Dollar and Twenty-five Cents ($1.25) per quarter year or part thereof.

(c) In the event a lot, parcel of land, building or premises discharging sanitary sewage, industrial waste, water or other liquids into the City sanitary sewerage system, either directly or indirectly, is not a user of water supplied by the Department of Water of said City and the water used thereon or therein is not measured by a city water meter, or by a meter acceptable to the Director of Water, then, in each such case the amount of water so used shall be otherwise measured or determined by the Director of Water in order to determine the sewer service charge or rental provided in this ordinance, or the owner or other interested party at his expense may install and maintain a meter acceptable to the Director of Water for said purpose.

(d) In the case a lot, parcel of land, building or premises discharges industrial wastes, either directly or indirectly, into the City sanitary sewerage system, and the Director of Water finds that it is not practical to attempt to measure such wastes by meter, he shall measure such wastes in such manner and by such method as he may find practicable in the light of the conditions and attendant circumstances of the case, in order to determine the sewer service charge or rental, according to the corresponding rates per thousand cubic feet provided in this ordinance.

(e) A discount of five (5) per cent shall be allowed for prompt payment.

In addition to the charge or rental determined according to the rates specified herein a further charge of five (5) per cent of such amount so determined shall be added thereto in each case of failure to make prompt payment, and the total thus obtained shall be the sewerage service or rental in each such case.

The period within which payment shall be made in order to be classified as a "prompt payment" shall be determined by the Director of Water and shall be expressed through the rules or regulations which he is authorized by this ordinance to make for the purposes hereof.

(f) The sewer service charge or rental provided in this ordinance shall be payable quarterly at the office of the Department of Water, and at the option of the Director of Water may be made payable at the same time as water bills in the district in which the property is located are payable.

(g) All lots, lands, buildings and premises located within the corporate limits of the City of Dayton, Ohio, and owned and used by the City School District for school purposes, all lots, lands, buildings and premises located within the corporate limits of the City of Dayton and owned and used by Montgomery County, by the State of Ohio and by the Federal Government for public purposes, together with all lots, lands, buildings and premises owned by the City of Dayton, are hereby exempted from said sewer service charge or rental, provided that nothing herein shall be construed as exempting the Dayton State Hospital for the Insane, the National Military Home for Disabled Soldiers of the United States, or the Wright Field, an aviation field maintained by the United States Government near said City from paying said sewer service charge or rental.

Section 4. For any lot, land, building or premises from which connection is made with the City sanitary sewerage system or which begins to discharge sewage, any industrial waste water or other liquids into the City sanitary sewerage system, either directly or indirectly, after this ordinance becomes effective, a charge shall be made pursuant to this ordinance, the same to be a per diem pro rata amount based upon the minimum rate per quarter from the time such sewer connection is made, or such discharge into the City sewerage system, either directly or indirectly, is begun, until the next following quarter period, except should the measured service exceed the minimum charge the corresponding measured rate or rates shall be charged.

Section 5. The charge or rental levied and assessed by this ordinance shall be payable in four quarterly payments in each year, as provided in Section 3, paragraph (f), hereof, provided that the amount of the rental payable for any lot or premises at the first payment period after this ordinance becomes effective shall be determined on the basis of a per diem proratement of the minimum charge herein established beginning with the date this ordinance becomes effective, except that in those cases in which the metered or measured charge will exceed the minimum charge, the metered or measured charge shall be the basis.

Section 6. Each charge or rental levied by or pursuant to this ordinance is hereby made a lien upon the corresponding lot, land or premises served by a connection to the sanitary sewerage system of the city of Dayton, Ohio, and if the same is not paid within thirty (30) days after it shall be due and payable it shall be certified to the Auditor of Montgomery County, Ohio, who shall place the same on the tax duplicate of said county with the interest

and penalties allowed by law and be collected as other taxes are collected.

Section 7. The charges or rentals levied pursuant to this ordinance shall be collected by the Department of Water, and the Director of said Department shall make and enforce such by-laws and regulations as may be deemed necessary for the safe, economical and efficient management and protection of the City sewerage system and the sewage pumping, treatment and disposal works, for the construction and use of house sewers and connections to the sewerage system, and for the regulation, collection, rebating and refunding such charges or rentals.

Section 8. The funds received from the collection of the charges or rentals authorized by this ordinance shall be deposited daily with the City Treasury and shall be accounted for and be known as the Sanitary Sewer Fund and when appropriated by the City Commission, shall be available for the payment of the cost and expense of the management, maintenance and repair of the City sanitary sewerage system and the sewage pumping treatment and disposal works, and any surplus in such fund shall be used for the payment of the interest on bonds issued and outstanding or which may be issued to provide funds with which to pay the City's portion of the cost of constructing such sanitary sewerage system, or part thereof, and such sewage pumping, treatment and disposal works and to retire such bonds when they mature, and or for the enlargement or replacement of said sanitary sewerage system, pumping, treatment and disposal works, except that no part thereof shall be used for the extension of such sewerage system into unsewered areas.

Passed by the Commission December 28, 1927.
Signed by the Mayor December 28, 1927.

Allen C. McDonald,
Mayor of the City of Dayton, Ohio.

Attest: E. L. Pletcher,
Clerk of the Commission.

Highland Park, Ill., Takes Bids

HIGHLAND PARK, wealthy north shore suburban community, populated by many of the leading businesmen of Chicago, is considering the proposition of constructing a new pumping station, filtration plant, and elevated tank, and it is expected that bids will be taken on this work on July 9. A bond issue of $850,000, it is expected, will be made available for this work, including legal fees and all other necessary related costs.

The existing waterworks includes two intakes in Lake Michigan, 16 in. and 20 in. in diameter, leading to an old steam pumping station, will be replaced by a modern electrically operated plant with gasoline engine driven standbys, according to the proposed plan, together with an up-to-date filtration plant of the required capacity.

The buildings, of structural steel and face brick, and roofed with slate, will be of Georgian architecture, shaped in the form of a T, will have a very pleasing appearance inside and out, and the grounds will be landscaped and extensively planted, and drives will approach the plant from the front, leading to front, side and rear entrances. Filter plant units, clear well, and foundations will be of reinforced concrete. An elevated tank with a capacity of 500,000 gal. and 115 ft. high, will be erected on a hilltop and enclosed in an octagonal brick structure of pleasing appearance. A new 16 in. force main about 7,800 ft. long, will be laid between the plant and this tank.

Pumping Station.—The pumping station will contain 4 low lift pumps as follows:

2 pumps, 3 M.G.D.
1 pump, 7 M.G.D.
1 pump, 9½ M.G.D.

In addition there will be 5 high lift pumps as follows:

1 pump, 2 M.G.D.
2 pumps, 3 M.G.D.
1 pump, 6 M.G.D.
1 pump, 3 M.G.D.

The latter will be a gasoline engine standby. Electric equipment will be provided to permit easy operation from the central switchboard and at the pumps as desired. A new intake well has been design that will allow cleaning of either or both intakes without shutdown and that will permit repairs to one with the other in operation.

Filtration Plant.—The filtration plant, of the rapid sand filter type, has been designed on the basis of a capacity of 7 M.G.D., and contains a clear water reservoir with a capacity of 1,400,000 gal. This plant will contain four filter beds, each of 1¾ M.G.D. capacity, four mechanically agitated mixing basins with a detention period of 50 minutes when all are in operation, and sedimentation basins designed for a detention period of 3 hours. These structures will be reinforced concrete. A chemical room with dosage equipment for both chlorine and alum has been provided, with provision for two chlorinators and two alum outfits.

Construction.—The building will be of structural steel with open steel truss arches over the filter room and trusses over the other departments. The exterior walls will be of face brick, while the interior of the walls will be faced with face brick and glazed brick wainscoting, floors will be of tile throughout, and the roof will be of slate over gypsum roofing. Ornamental brass work will be used on the interior around pump pit wells, and for balustrades and similar work. In all, the construction will be of the best, and in design the structure will be worthy of the high class residential property of the community.

The work has been planned by Pearse, Greeley and Hansen, 6 N. Michigan ave., Chicago, Ill., at which office further information may be obtained.

How Street Parking Affects Street Cleaning

In a paper presented at the last annual conference of the International Association of Street Sanitation Officials, Mr. E. A. Wood, Chief of the Street Cleaning Division of the city of Winnipeg, Man., gave some interesting information on the changes in street cleaning methods due to parking of cars in the business district. An abstract of his paper follows:

The parking of motor vehicles on public thoroughfares is one of the evils of the motor age, and is the cause of much concern on the part of street sanitation officials.

A very large percentage of the motor vehicles of a community are operated for the purpose of carrying on business enterprises of one kind or another either directly or indirectly. Consequently these vehicles, during business hours, operate in the business sections of a city, causing congested conditions on streets in those areas.

Street cleaning officials have learned, through experience, that it is no longer practicable to attempt street cleaning in these areas during business hours, for several reasons. Vehicles parked along the curbs prevent the economic operation of motor pick-up sweepers, they also reduce the width of the street surface available for moving traffic. This causes a heavy volume of traffic in the space between the parked vehicles into which it would be extremely dangerous to attempt street cleaning by the white wing method, and if it were attempted only a very small percentage of efficiency could be expected to result therefrom.

These changing conditions have brought about the practice of street cleaning after midnight in these business areas. Even after that hour, the work of the street cleaning gangs is handicapped by the presence of parked vehicles on streets. To overcome this condition, several methods have been experimented with.

A number of cities have enacted ordinances making it unlawful for vehicles to be parked on streets within a certain specified area between the hours of 12 o'clock midnight and 5 A. M., unless such vehicle is in charge of a competent driver. The driver of said parked vehicle must promptly move same upon the direction of any employe of the street department engaged in street cleaning. In cities where such an ordinance is in force, satisfactory results have been obtained.

In other cities where regulatory ordinances are not enacted, street cleaning officials take the law into their own hands, and wherever a vehicle is found parked on a street in such a manner as to interfere with street cleaning operations, the said vehicle is towed to a side street out of the area of cleaning. This method, while very effective in the majority of cases, is not the ideal condition under which to operate, as it is liable to embroil the city in legal encounters.

Other street cleaning officials are laboring under the handicap of having no regulatory ordinances, or other methods of combating the parked vehicle evil. Needless to say, the highest standard of efficiency cannot be expected under these conditions.

In conclusion, it would appear that street cleaning officials must resort to the enactment of ordinances in order that their necessary work may be carried on, in business sections of cities, without undue interference in the nature of parked vehicles.

Control of Stresses in Large Welded Pipe Line Construction

Results of Study of Pipe Line Stresses

By LLOYD T. JONES and WALTER S. WEEKS
Professors, University of California, Sacramento, Calif.

THE stresses which are met in construction may be divided into the following groups:

Line stress.
Differential-Temperature Stress.
Residual Welding Stress.

Line Stress.—The stress which I thus designate will be best understood by referring to Fig. 1. It is evident that during the forenoon, under a rising temperature several hundred feet of the pipe line will carry outward along the ditch due to compressive line stress. The stress at the free end is zero. At B the stress will be larger than at A, at C still larger, etc. The line stress will be only that which is necessary to move the pipe against earth friction. During the late afternoon and evening the pipe will contract. During the process of retraction there is a tension in the line which I call line tension and which is equal to the frictional resistance of the pipe being pulled back. When the pipe stops contracting this tension remains in the line. As more pipe is added this tension remains and is built permanently into the line. It is present in riveted pipe lines as well as welded ones.

It is not due to any faulty method of construction and it can not be entirely eliminated. Its magnitude in a pipe line of large diameter may be 8,000 lb. per square inch. Laying the line in groups of 20 sections each and joining the groups will reduce this stress to about half as much.

Differential - Temperature Stress. — This is the stress due to the welding or riveting of a pipe line into a straight line at a time when there is a difference of temperature of the top and bottom of the pipe. Differential-temperature stress in large lines is frequently due to a temperature difference as large as 50 deg. F. This temperature difference produces a stress of 10,000 lb. per square inch which will exist in the top fibers when the pipe cools to uniform temperature. This stress can be eliminated by making all girth joints during those hours when top and bottom temperature are equal. The few miles of Mokelumne Line whose girth joints were electric arc welded were made free of differential-temperature stress by welding at night. They did not break.

Residual Welding Stress.—Those of you who may have read the results of the investigation of the welding of the Mokelumne Pipe Line will remember

Fig. 1.—Line Stress at Any Point Is the Stress Necessary to Push or Pull the Pipe Extending Beyond That Point. If the Point no Longer Moves Line Stress Remains at the Value when Motion Last Occurred

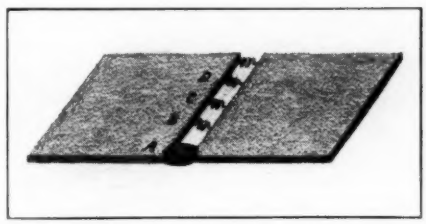


Fig. 2.—The Deformation Produced in Welding Is Due to Expansion of the Heated Metal and the Contraction During Solidification and Cooling

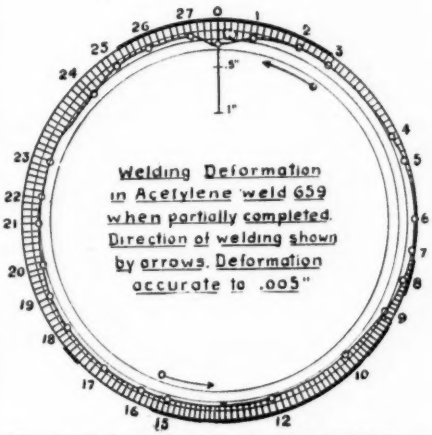

Welding Deformation in Acetylene weld 659 when partially completed. Direction of welding shown by arrows. Deformation accurate to .005"
.5"
1"

Fig. 3.—Deformation Due to Girth Weld in a 65 in. Pipe Line. Width of Shaded Area Represents the Amount of Axial Deformation, if It Is Uniform the Residual Welding Stress Is Usually Slight

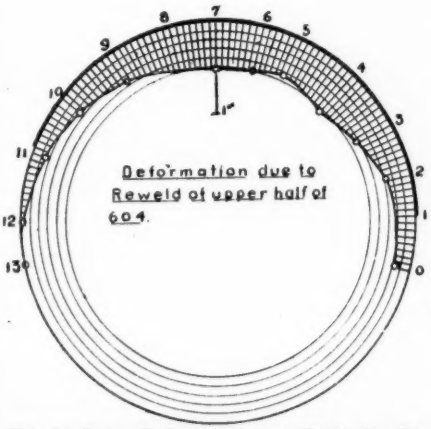


Fig. 4.—Large Deformation in a Particular Reweld of a Broken Girth Joint. The Parent Metal of the Pipe Was Permanently Stretched

the emphasis placed on the seriousness of residual welding stress and may also remember the dismissal of the subject with the statement that in a line properly welded residual welding stress should not exist. By residual welding stress I mean that stress which resides in the completed piece by virtue of the fact that it was joined by welding as opposed to any other method. This stress is due to the shrinkage that occurs in steel during its solidification and cooling to normal temperature. Residual welding stress may be perhaps best illustrated by Fig. 2 which represents two steel sheets being welded edge to edge, the distance apart is exaggerated. Instead of weld metal I have indicated small coil springs joining the two edges. At the start of the weld the metal deposited at A will solidify and will then act as a fulcrum. The metal next deposited at B, C, D, etc., on cooling will produce tension to turn the two sheets about this fulcrum. Unfortunately the problem is complicated by the fact that the fulcrum continually advances.

Figure 3 indicates the deformation in one of the welds of a 65 in. pipe. The deformation, and consequently the residual welding stress, is represented by the width of the shaded area. It was fairly uniform, the maximum being about 0.200 in. A differential deformation of half this much however, represented a stress of approximately 9,000 lb. per square inch.

Figure 4 indicates the distortion which was produced by re-welding the upper half of one joint of a 65 in. pipe which had broken. The portion re-welded is indicated by the heavy black line. The deformation produced by the re-welding is plotted radially and indicated by the shaded area. The upper sheets of these two adjacent sections were drawn together ½ in., with the lower portion of the pipe unmoved, and mind you this metal was ½ in. thick and the pipe 65 in. in diameter. This deformation indicates a stress far beyond the elastic limit of the metal. I indicate this merely to show the serious magnitude of stresses that may be introduced as residual welding stress. It may be of interest to you to know that after that re-weld was completed, even though this great stress was introduced the weld did not again fail.

Method for Eliminating Stress.—There are three ways to produce pipe

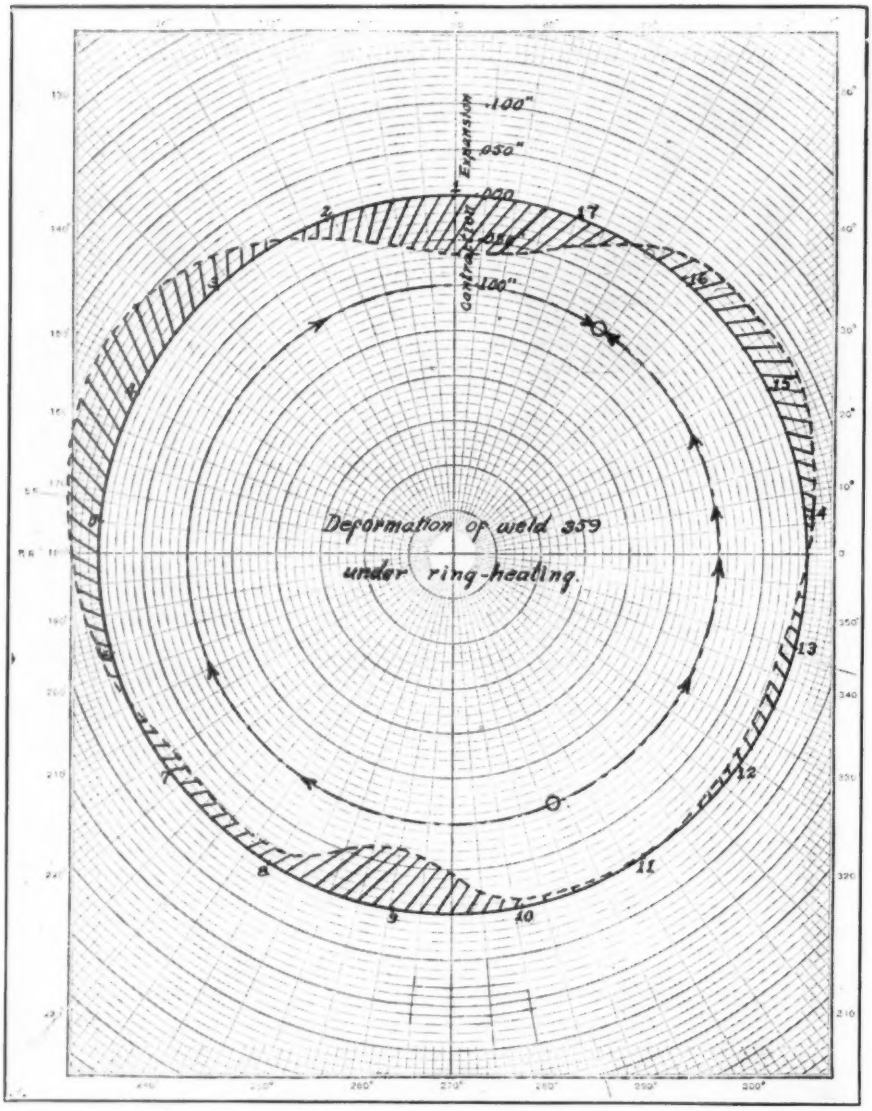


Fig. 5.—Relief of Residual Welding Stress Afforded by Simultaneous Heating of Whole Girth Weld

line girth welds without residual welding stress.

Figure 5 shows the relief of stress that was effected on one particular joint of the 65 in. pipe line by the simultaneous heating of the whole weld. Ten acetylene torches were used to bring the whole weld to a uniform red heat. You will notice that in some places the weld metal elongated and in some places contracted, indicating that forces of tension and compression respectively had existed. While this method has the additional advantage of controlling the crystal structure of the weld metal I nevertheless do not believe that it is economically feasible. While it is a possible method it must nevertheless be disregarded.

A second method is suggested by the discarded one however. If it were humanly possible to produce the whole weld simultaneously or to have the whole weld hot at the same time it would be possible to produce a weld without serious residual welding stress. Although this has been accomplished on small diameter pipe it is not yet suitable for the construction of large lines.

The third method for eliminating residual welding stres was brought to my attention by H. E. Kennedy. It is a method that is new but I say immediately that I have the utmost confidence in it. I have measured welds that have been produced in this manner and have found them to be with virtually zero residual welding stress.

Figure 6 shows adjacent ends of two pipe sections ready to be welded. Each is provided with a narrow flange rolled at right angles to the axis of the pipe. These flanges are placed with their faces in contact and then are welded along their peripheries. The design of the flange is dependent upon the conditions of stress the completed line is to be called upon to withstand. It is happily true that in this weld the residual welding stress is nearly zero. Several types of flange weld have been tested.

Before I present a detailed comparison of the flange weld and its predecessor the butt weld I would like to show you (Fig. 7) comparative values of the residual welding stress of the two types of weld on 16 in. x ¼ in. pipe. The tests on 16 in. pipe were made with the cooperation of R. S. Fuller and R. V. Wilson of the Pacific Gas & Electric Co. You will note that the deformation of the metal of the pipe proper is greater for the butt weld than for the flange weld. May I add the statement that these welds were both made by Mr. Hopkins the same day and under as nearly identical conditions as possible.

These values of deformations are not to be taken too literally. If I were to take sufficient time to present the matter clearly I believe I could prove to you that in these two particular welds the stress in the pipe due to the flange weld does not at any point exceed 3,480 lb. per square inch and that in one portion of the butt weld the stress is equal to the elastic limit of the parent metal. There seem to be two portions of this butt weld that are under compression, the two alternate portions being in tension.

The reasons why pipe line welds break and why they break only part way around and virtually never for the entire circumference are indeed becoming quite clear. A detailed discussion must be postponed however, till more time is available. In justice to butt welds may I state that this particular one is a beautiful weld and that it will never in the world fail, although the metal is severely stressed, because the weld is stronger than the parent metal.

Comparison of Two Types of Welds.—Now let us make a more detailed comparison of the two types of welds.

In the butt weld the residual welding stress is in the plane of the pipe sheet.

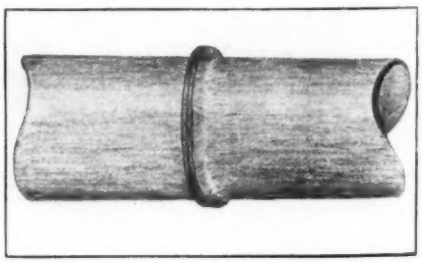


Fig. 6.—Pipe Sections Flanged, Ready for the Peripheries to Be Welded

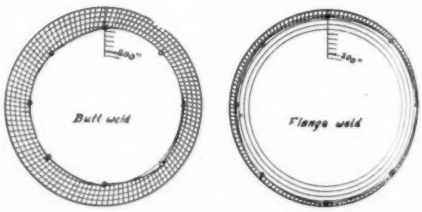


Fig. 7.—Comparative Deformations in Butt Welds and Flange Welds in 16 in. x ¼ in. pipe

In the flange weld it is at the periphery of the flange and can be transmitted to the pipe sheet only by the flange.

The flange is designed to yield by bending long before a serious axial stress in the pipe is reached.

In tests on 16 in. x ¼ in. pipe the elongation was shown to be 0.30 in. per joint before the flange weld showed signs of distress. No buried pipe line will ever be called upon to provide so much motion in relief of stress. The stress equivalent of this 0.30 in. is 40,000 lb. per square inch.

The flange weld is not an expansion joint but rather is an expansible joint which can permanently elongate to relieve excess stress. The butt weld cannot elongate to relieve stress.

The flange weld lends itself admirably to group laying. The joining of groups is less difficult than with the butt weld. It is equally easy to remove a section and replace it as occasion may demand.

The flange weld not only affords relief from residual welding stress but also it functions to relieve line stress, Poisson stress, cold water stress and even differential-temperature stress. These four stresses the butt weld cannot relieve.

With the flange weld there is no accidental formation of stalactites to impede flow.

The relative costs of the two types of weld may be judged from the fact that for the two welds in 16 in. x ¼ in. pipe the flange weld (not including the cost of forming the flange, since it was done by hand) was less than 70 per cent of the cost of the butt weld. Including the turning of the flange by hand it was only equal to the cost of the butt weld.

I repeat that in this weld I have the utmost confidence and I might be accused of not telling the whole truth if I did not state that I consider it to be the most notable contribution to pipe line construction since the advent of welding.

Acknowledgment.—The foregoing is an abstract of a paper prepared by Professors Jones and Weeks, and read by the former at the 1928 convention of the American Water Works Association.

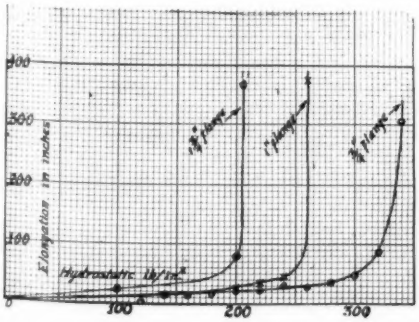


Fig. 8.—Water Pressure Elongation Tests on 16 in. Pipe to Determine the Width of Flange Necessary to Withstand the Stress the Line Is to Undergo

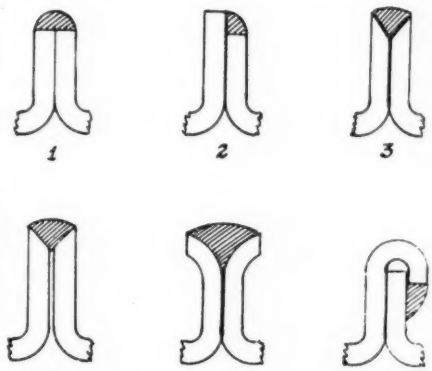


Fig. 9.—Types of Flange Weld. No. 6 Is Particularly Suited for Electric-Arc Welding

The American Water Meter Institute Organized

After several discussions among interested parties, whose names are given herein, an association to be called The American Water Meter Institute has been organized, and at a meeting held at the Engineers Club of New York City on May 22nd, immediate organization being agreed upon, officers were elected and committees appointed, and the following definite aims and objects of the Institute are set forth for the information of the trade, the public and the members' own organizations, and were signed by an executive of each of the subscribing members whose names are given below.

The American Water Meter Institute has been organized by manufacturers of water meters for the purpose of co-operation with customers and all others who are interested in promoting the welfare of the water works industry.

Any manufacturer of water meters whose business is conducted principally in the United States is eligible to membership.

The purpose of this Institute are mainly as follows:

1. To eliminate practices and methods detrimental to the entire water works industry.
2. To work for the further acceptance of the present "Standard Specifications," so that the members of the Institute may be protected against unnecessary changes in formulae of materials or changes in design and construction, unless and until such changes are warranted by the progress or the needs of the industry, and to eliminate unreasonable specifications and guarantees.
3. To promote open discussion of trade conditions and to bring about a clearer understanding of the problems of the manufacturer, vendor and consumer.
4. To act jointly on such problems as freight rates, exhibits, attendance at conventions, and such other matters as affect the industry.
5. To promote the use of water meters wherever possible and to make a concerted effort to show the public in general and publicly owned water works' officials in particular, that the use of water meters is desirable because it prevents waste of our natural resources, reduces taxes, and promotes public health and welfare.

The Institute will seek definite approval for its work from the Federal Trade Commission.

The above outlines the objects of the Institute, which will welcome the co-operation of other associations having kindred aims for the general promotion of the water meter business.

The officers elected for the ensuing year at the meeting of May 22nd were:

W. F. Rockwell, President.

J. B. Kirkpatrick, Vice-President.

R. S. Bassett, Secretary and Treasurer.

and the following companies, through their executives, have taken membership in the Institute:

Badger Meter Manufacturing Co.
Buffalo Meter Co.
Federal Meter Corp.
Gamon Meter Company.
Hersey Manufacturing Co.
National Meter Co.
Neptune Meter Co.
Pittsburgh-Equitable Meter Co.
Union Water Meter Co.
Worthington Pump and Machinery Corp.

New York City Has Air Engineer.—Clarence Chamberlain has been appointed consultant on the construction of the municipal airport of New York City at Barren Island. The appointment carries with it the title of Aeronautic engineer and a salary of $1,000 per month.

How to Get Public Cooperation in Keeping Street Clean.—A paramount fact which must not be lost sight of in seeking the cooperation of the public is that there is nothing which encourages carefulness upon the part of the public so much as efficient and careful cleaning by the Department. One does not hesitate to throw paper or rubbish onto an untidy street, but would think twice if the street were clean.—George W. Dies, Street Commissioner of Toronto, Ont., in his annual report for 1927.

Motor Sweeper Picks up Leaves.—A novel idea at Flint, Mich., is the use of a motor sweeper to pick up leaves from the parkway strip. Residents are requested to rake their leaves to the edge of the curb just before the street is cleaned, and the sweeper brush is raised several inches to pick them up.

Desirable and Reasonable Traffic Regulations For General Use

An Outline of the Details of General Traffic Control

By E. W. JAMES

Chief Divison of Design, U. S. Bureau of Public Roads, Washington, D. C.

IN the course of the last ten years the civil engineer who has made highway work his specialty has found that a new phase of highway activity has been rapidly growing in importance. We were formerly concerned with highway construction and maintenance; we are now concerned with highway construction, maintenance and operation, and by no means the least of these activities is highway operation. While highway transport is acquiring more and more the characteristics of railroad transport in many of its aspects, highway transport is characterized by, and must be protected in, retaining the element of flexibility which makes it of such outstanding importance. We have a relatively high-powered vehicle which does not operate on individual trackage. We place at the throttle of this vehicle any person with ordinary intelligence. The manufacturer is constantly striving to widen his market, and cheapen the equipment to a point where it will be available to smaller and smaller incomes and a constantly extending use.

The automobile is rapidly becoming an expression of American life. Freedom of movement, like freedom of speech, freedom of the press and freedom of worship are fundamentals of American liberty, and the outstanding instrumentality of freedom of movement in America today is the individual automobile and the commercial truck. Thirty years ago, when our automobile registration was 4,600, we were figuratively still sitting at the feet of the French road builder, taking lessons in the testing of materials, the drafting of specifications and methods of construction, and no state in the Union had an improved highway entirely across it in any direction. Since then we have become the foremost road-building nation of the world, and our progress in the science and art of highway construction has been so great that today all the world is turning to the United States for ideas and guidance in the expansion of their own older highway systems. The automobile industry has grown until it has produced in excess of 4,000,000 vehicles in a single year, to accommodate which on a 15-ft. headway would require over 21,000 miles of highway. To construct, maintain and operate highways under such pressure is a matter of the greatest national urgency. With respect to the operation, with which we are particularly concerned, our problem is twofold,—to make adequate provision for what we have in the way of transport, and to take preventive measures against a national jamb in the future.

If funds are forthcoming, the highway engineer can take care of construction and maintenance. The highway-building industry is today equipped to take care of any probable emergency in this direction. The serious problem lies in the field of operation. As conditions exist it is more dangerous today to drive a car than it is to have typhoid or diphtheria or both, and to drive a car for ten years is more dangerous than to be called upon once in ten years to serve in an expeditionary force in a great foreign war. In the last ten years we have lost by death in automobile accidents about 30,000 more than the entire losses in battle, by disease, suicide or accident during the period the United States was engaged in the World War.

The railroads have found it necessary to establish elaborate and exact operating regulations. Railroad engine drivers are highly skilled men of mature years, physical soundness and having good judgment. Our great problem is to establish an equally efficient set of operating rules, applying them to the drivers of automobiles and trucks, and do this in a manner which will not destroy the outstanding advantage of motor transport which is its great flexibility.

I submit to you two fundamental principles which I think must apply in such an effort; these are the rule of uniformity and the rule of reason.

Rule of Uniformity.—I believe the first rule is generally accepted. We have had the Hoover conference on street and highway safety prompted solely by an effort to induce unified action by the several States in all matters pertaining to highway traffic, including traffic regulations. Out of this conference has grown the Committee on Municipal Traffic Regulations, which is now actively engaged in formulating the details for the regulation of traffic in municipalities. The Association of State Highway Officials has undertaken to promulgate a uniformity of highway marking, including a variety of caution and danger signs. As all of this work has progressed it was found that there existed so great a variety of regulations, rules on the road, and methods of conveying instructions as to amount almost to a chaotic condition. In the three and a half years since the meeting of the first conference on street and highway safety there has been a decided change for the better, but much remains to be done. The immediate accomplishment has been the general acceptance of the rule of uniformity. When a man can drive in any city or in any State with the same confident familiarity with driving requirements that he possesses with respect to his own community, I believe much will have been done to reduce the needless stream of accidents that now flows along with our highway traffic. In admitting that the application of this fundamental rule is difficult and will be slow, I speak from a full and wide experience, but past performance is encouraging, and I believe that we may look for the relinquishment of pet ideas, of the desire to be different, and of the tendency to enforce unique restrictions, and for the ultimate adoption of regulations which may be everywhere communicated in approximately the same form and enforced in essentially the same way.

Rule of Reason.—The rule of reason does not yet occupy so sound a place in our public handling of traffic problems. This always characterizes the rule of reason when applied to any activity. Devising a test of reasonableness is the very first difficulty. Shall we, for instance, base our test of reasonableness on speed or on congestion? In order to avoid the latter, shall we throw down the bars to speed? In order to avoid speed shall we aggravate congestion?

In the last three or four years there has been a pronounced tendency in State traffic laws and local regulations to permit, or even encourage, high speeds. On the other hand, some investigators have shown that a traffic lane will deliver per hour more vehicles operating under safe conditions and at a speed of 15 miles an hour than at any higher speed. In some cases the whole question is dodged by an effort to control reckless driving only, whether this is required in speed or in handling the car. I am of the opinion that a substantial per cent of our accidents today are the result of overspeeding with respect to the conditions existing. We can imagine congestion, but it is diffi-

cult to imagine a serious automobile accident if all cars were operating at six miles an hour. The fact that 63 per cent of the accidents in Connecticut occur on good road surfaces, that 59 per cent occur in daylight, that 78 per cent occur in clear weather, that 38 per cent occur on a clear course, and the further significant fact that the rate per one thousand accidents for drivers under twenty years of age is three times that of drivers over thirty and four times that of drivers over fifty confirms me in this opinion. This is further supported by the fact that the driver is considered to blame in 74 per cent of all cases.

The adjustment to be made in determining the rule of reason as applying to speed and congestion is to fix after adequate study what will reduce congestion to the lowest amount obtainable with the greatest safety. If this results in relative congestion on our streets and highways, then the remedy is other routes or wider routes. This is the sound way to take care of all conditions which exist, and indicates the preventive measures for the future to which I have already referred.

Results of Surveys at Cleveland.—Recent surveys have been made in the vicinity of Cleveland, O., and in the city, where there exists on different routes a great variety of traffic, and where there is at some points an excessive and annoying congestion. A space-time recording apparatus was used for determining changes in speed and distances covered. A careful census of total traffic was made on all the routes studied. In operating the test car, carrying the space-time recorder, the experiment required that the operator put the car into the stream of traffic and keep it there as nearly as possible in coincidence with the general flow of vehicles. If one car passed him, he was instructed to pass one car, thus retaining his relative position in the line of traffic, but he was not to weave about with the purpose of gaining advantage in position so that he might increase his speed. He deliberately operated with the general flow of traffic. A recorder kept notes of events during the run, and the figures which I have to submit are those which were produced where conditions of congestion were just avoided. It was found that where the traffic on a 2-lane road was at the rate of 3,000 per day (twenty-four hours) an average speed of 36 miles was possible. With 4,000 traffic per day a speed of 34 miles was attained; with 7,250 a speed of 25 miles was recorded. On a road which was unnecessarily wide for two lanes, but hardly qualified as a 3-lane road because of parking conditions, a daily traffic of 8,500 vehicles permitted a speed of 28 miles, and a daily traffic of 12,250 a speed of 24 miles. If this is considered a 3-lane road it will be seen that these values fit in exactly with the previous figures for a 2-lane road on the basis of traffic per lane. On a 4-lane route the the following conditions were observed: When 12,000 vehicles per day were passing, a speed of 29 miles was possible; with 17,000 vehicles the necessary speed dropped to 28 miles; with 29,000 vehicles the speed was 24 miles an hour; and with 32,000 the speed was 23½ miles per hour.

Studies were made on other routes with somewhat greater refinement with respect to the traffic census. On a certain 6-lane road with 1,300 vehicles per hour a speed of 16 miles was attained; with a traffic of 1,700 per hour a speed of 14 miles was indicated by the tests. A similar more refined study on a 4-lane route covering 1,300 per hour indicated a speed of 16 miles per hour, and one covering 1,500 per hour the speed was forced down to 9 miles. These studies, while indicating higher speeds for the most part than those resulting from a mathematical study such as that made by Dean A. N. Johnson, clearly show, nevertheless, that a given traveled way will carry more vehicles at a lower speed under average conditions of operation.

The accidents reported in the city of Cleveland and shown on a spot map indicates that along the routes where the above figures have been secured the relative safety of driving is what may be referred to as normal or average. With the speeds and the traffic indicated the rate of accidents per 1.000 vehicles was neither substantially above nor below the rate on other thoroughfares.

This still leaves us in doubt as to whether a further restriction of speed would or would not reduce the accidents on these particular routes, but the studies are reasonably conclusive that the speeds were not so low as to be the cause of congestion, inasmuch as the capacity of the routes was continuously increased down to the lowest speed indicated. The result of these particular studies, therefore, would appear to indicate that speeds above 20 or 25 miles per hour are not necessary to reduce congestion. If carefully coincident studies could be made to determine whether accidents on these particular routes or other routes similarly studied are at a greater rate for higher speeds, it will probably be possible to fix upon a reasonable speed which will reduce accidents to a minimum and at the same time cause no congestion and maintain the capacity of the route at as high a point as can be conceded to the demands for saving time. Whether a similar speed limit should be fixed for the open highway is a question which should receive further careful study along similar lines, and in coming to a conclusion it should be borne in mind that one of the purposes of present regulations is to prevent future traffic difficulties. It is therefore better to maintain relatively low speeds not absolutely required by route capacity at this time in order to avoid the necessity of re-educating the public to low speeds in the future after they are thoroughly accustomed to high speeds.

Red and Yellow Lights.—There are several other matters which are still in the debatable zone when we apply our rule of reason, and conspicuous among them is the use of red and yellow lights. Red is almost universally recognized on the highway as a stop light. The Association of State Highway Officials, however, has adopted a stop sign with a yellow background, and the question of red or yellow for automobile tail lights is still unsettled. It occurs to me that there is a rather nice distinction that can be made with respect to the use of red or yellow which may be stated somewhat as follows: red signifies to stop and to remain stopped until the signal changes or some other instruction is given to proceed; yellow signifies caution, and if a yellow sign instructs traffic to stop, it indicates that extreme caution is necessary and that traffic should stop, but may then proceed past the stop sign without change of signal or other instruction when the driver is assured that he may safely proceed. This formula appears to come nearer fitting all of the conditions logically than any other I have heard. It permits the continued use of red tail lights, red lanterns on fixed obstructions, and yellow boulevard stop signs where the intersection is not automatically or otherwise controlled.

Where control lights are operated at an intersection the color cycle also varies. According to present practices it is "Red-Yellow-Green-Yellow" in some cases, and "Red-Green-Yellow" in others. The use of the yellow interval between the red and green is in question. The present trend of opinion, however, appears to be in favor of the "Red-Green-Yellow" cycle, and the reason for this appears sound. On the open street the yellow should flash, while the red still shows on the closed street; then when the yellow goes off the red goes on the formerly open street; the green should at the same instant come on the formerly closed street. This sequence gives warning on the open street that the red is about to flash, and provides opportunity for the intersection to be cleared before the green goes on the intersecting route.

Pavement Markings.—There is a growing tendency to use pavement markings, and a word should be said regarding more particularly the use of the continuous white line. It appears desirable that the continuous white line should be used only where it should never be crossed. This is a simple rule which the public can easily learn even if they disregard it in practice. Such a white line is the best possible witness in case of an accident. The man whose car is on the wrong side of such a line has no justification whatever. If such continuous lines are used where they may be crossed and where they may not be crossed confusion will always exist in the minds of drivers. Practice in

the use of the continuous white lines is gradually crystallizing for the following uses:

(a) Centerline on a curve having a radius of less than 600 ft.
(b) Centerline on a grade steeper than 6 per cent.
(c) Centerline on vertical curves where the clear sight distance is less than 500 ft.
(d) Traffic lanes on streets wide enough for three or more lanes, where direct approach to certain critical areas is necessary.
(e) Street-car landing areas.

Where white lines are considered necessary to indicate the boundary of pedestrian cross-walks, of vehicle turning limits at street intersections, at street-car clearance limits at turning points, or to indicate parking space, broken lines should be used.

Considerable difference of opinion still exists with respect to the time and method of making left and right turns at controlled intersections. Left turns are sometimes made on the outside of the intersection; sometimes closely around the center of the intersection. Right-hand turns are sometimes permitted and sometimes not permitted against the red light on the closed street. These two sets of conditions must be handled together.

In the first place, if we are to adhere to the significance of the red light, a right turn should not be made against it. If this is established, then the left turn at the center of the intersection will tend to obstruct traffic more or less seriously whenever vehicles waiting the right turn are standing close to the intersection. Therefore, if right turns against the red light are prohibited, left turns should be made on the outside of the intersection. This relation appears to be the soundest solution. It can be used on both wide and narrow streets where control is automatic or by police direction, and it throws all vehicles waiting both the left and the right turn over to the extreme right-hand side of the approaching street and intersection. Any other combination appears to have some greater disadvantages.

I have confined myself to those details of general traffic control which are at the present time most in dispute. Other details which are subject to a variety of adjustment are controlled by local situations existing. For instance, the one-way street has its supporters and its opponents, but after all it is a matter of the physical routing of traffic rather than a rule of the road. The parking question is a very serious one and widely and vigorously disputed, but it is a purely local question in every instance, and often it is local to individual streets or to blocks in a single street.

Such questions, however, are of the greatest significance in pointing the way toward those preventive measures which must be seriously considered if we are to meet future conditions which now appear probable. These preventive measures have very wide ramifications. They involve not only the question of routing and of parking space, but the details of highway and street design, and ultimately of city and regional planning. In all of these directions some work is being done, but we are not yet ready to draw definite conclusions with respect to many of the details. Highway engineers are perhaps more nearly in agreement on details of design to accommodate traffic than traffic directors are with respect to one-way streets or the parking privilege. And those devoted to city and regional planning are carefully studying the questions of building height and capacity, street layouts, decentralization, and the segregation and grouping of various business activities. All of these matters are involved in preventive measures for the future, which will make possible the continuation of urban growth and development without burdening such communities with exorbitant expenditures to overcome chaotic and impossible traffic conditions.

Specifically, at this time we are in need of information regarding the traffic density on 2, 3 or 4 lane intersections when automatic signals should be introduced, and the further point in traffic density when police control should be adopted. There are still to be found many who believe that traffic moves more rapidly and even more safely when it is permitted to make its own way through intersections. Undoubtedly traffic control has been installed where not needed. This is because we do not know for any given case what the critical points of capacity are. This should be studied.

Further studies should be made regarding the increased efficiency of a highway due to the introduction of rotary intersections or grade-crossing separations. Theoretically a grade-crossing separation should give us an increased efficiency of at least 50 per cent. It is probably more than that. Such a large saving may warrant the expenditure of much greater sums for this kind of work than we have believed justifiable heretofore.

Studies regarding the detailed design of rotary intersections are imperatively necessary at once. The Bureau of Public Roads is now considering a rather wide study of this last matter, and it may be expected that within a reasonable time some data much more valuable than any now available will be in hand.

The use of this material is going to be necessary in the near future, for it requires but little imagination to picture the impossible condition which will result if we depend entirely on methods of immediate control for the solution of all possible traffic problems, and reject those preventive measures which promise so great an advantage for the future.

Acknowledgment.—The foregoing is a paper presented April 18 before the Affiliated Technical Societies of Boston.

Proceedings Texas Water Works School

Procedings of the Tenth Texas Water Works School, distributed by the Texas Section of the Southwest Water Works Association at $1.00 per copy, E. G. Eggert, treasurer, Austin, Tex. On lots of ten or more copies 40 per cent discount is allowed.

The volume is divided into two sections, one devoted to water and the other to sewerage and covers 294 pages. The two subjects are rather fully gone into considering that the material was prepared for a four-day program which had to represent the varied interests of the water and sewerage plant operators in Texas. The papers were preprepared by some of the foremost men in their respective fields in America and foreign countries.

H. W. Streeter of the U. S. Public Health Service discusses filter plant loading and stream pollution; microscopic life in water is treated by Dr. Asa Chandler of the Rice Institute, Houston, Texas; Dr. Karl Imhoff tells how he calculates the capacity of sludge digestion tanks; Arthur J. Martin, consulting engineer of London, discusses activated sludge problems from the English standpoint, while G. L. Fugate and J. C. McVea, engineers of Houston, Texas, disclose some of the secrets of a successful activiated sludge plant in Texas as exhibited by the Houston installation. Dr. Willem Rudolfs of New Jersey Experiment Station fame points the way toward a comprehensive sewage research program for Texas.

The special water problems of Waco and St. Louis are discussed by a water superintendent and a water commissioner, respectively, who have had charge of their plants for a number of years. While some of the recently installed and especially interesting sewage plants are described and illustrated, including that at Fort Worth, Houston, Jacksonville and Waco.

Cost of Street Cleaning at Washington, D. C.

The following table from the report of the operations of the engineer department of the District of Columbia shows the unit cost of street cleaning for the fiscal year July 1, 1926, to June 30, 1927:

	Area, square yards	Cost per 1,000 sq. yd.
Horse sweepers	70,843,000	$0.313
Hand sweepers	60,126,000	.176
Alley cleaning	103,250,000	.571
Suburban cleaning	57,831,000	.447
Hand patrol	1,739,011,000	.122
Motor flushing	705,056,000	.0714

Uniform Accounting Systems for Water Works

Paper Read at 1928 Convention of
American Water Works Association

By R. B. F. CHISHOLM
Secretary, California Water Service Co., San Francisco, Calif.

ACCOUNTING may be defined generally as a procedure relating to the assembly and recording of facts in business transactions in an orderly, chronological manner, so that periodical statements may be rendered, showing the financial position of any business enterprise and the results from operation; and may be considered as the right hand of management or administration.

Accounting embraces a large field:
General Accounting.
Plant Accounting.
Cost Accounting.
Stores Accounting.
Revenue Accounting.
Budgeting.
Accounting Systems.
Systems of Internal Check.
Statistical Information.
Payroll Accounting.
Expense Accounting.

Accounting for Capital Stock and Dividends, etc.

Accounting is based on theory as well as fact. Theories or mental speculations, as they may be called, after having been tested by long usage, have become established as principles, which in the accounting field become known as principles of accounting. However, accounting principles are subject to development, evolution and change, so that principles laid down in the past must not be considered as iron-clad, but as subject to continuous improvement. Each and every business problem must be solved by the accountant, not on the basis of an accounting formula, not on the basis of precedents relating to methods adopted by others, but on that of the conditions prevailing and of the objectives to be accomplished in each case.

When we speak then of uniform accounting for our own field, we must keep the above thoughts in mind and realize that often local conditions, local policies, etc., must be considered and to some extent may require modifications of any principles of uniform accounting which we may endeavor to lay down at this or any other time.

Uniform Accounting.—Uniform accounting for water utilities can best be expressed through uniform classifications of accounts, but uniform classifications of accounts do not necessarily result in uniform accounting as different accounts may classify items under entirely different heads. For example:

Overhead expense, such as salaries of officials, general management and supervisory costs are absorbed by some companies entirely in expense and others allocate same on a basis of construction and operating expense. Accurate application of these expenses is very essential so that neither construction nor operation will be burdened unduly.

Where a utility charges a large part of its overhead to construction, the fixed capital account is, of course, increased and the operating expenses are reduced to a minimum. Such a practice might result in a reduction of rates by public utility commissions. On the other hand, if operations are charged with a large overhead, which should apply to construction, then the commission would probably allow a very small overhead on the property with the result that a large return may be earned on less than its true cost. Utility companies should endeavor to allocate these overheads to both construction and operation on the basis of actual work performed. This would also apply where a utility handles gas and electric or water, the overhead costs being distributed on as nearly an equitable basis as possible to the actual cost of each department.

This procedure, as we all know, is on the basis that even though aside from the importance of having records prepared and kept correctly that it is preferable to earn on expenditures over a long period of years that should be capitalized rather than getting such items allowed as expenses for that particular year only.

The wages of construction foremen and other supervision of labor should be handled as direct labor costs and not included in the overhead expense. It is desirable that the accounting policy in connection with the cost of engineering and general supervision work for construction should be followed as closely as possible with the practices of valuation engineers in setting out the cost of engineering and supervision, apart from the unit cost of labor and materials charged directly.

Construction should also be charged with reasonable proportion of legal expenses, compensation insurance, public liability insurance, taxes, and also interest on the money expended during the period of construction. Various methods are in use in determining these ratios and some utilities consider these items as direct charges, while others include them in overhead.

Indirect expenses, such as purchasing, stores, etc., may be absorbed in the case of overhead expense in operation or allocated properly to construction and operation.

We consider that the cost of purchasing supplies, handling of stores and small items of freight and hauling are properly chargeable to the unit of cost of the material. It appears to me that the most logical way to handle these expenses is to allocate them on the basis of the cost of materials used on construction and operation. Some companies follow the practice of charging out materials at the actual cost as shown by the stock cards, but I believe that the simpler method of withdrawing materials from stock is to use the average cost system.

Minor replacements or repairs are absorbed by some companies entirely in expense and by others absorbed partially, at least, in depreciation reserve. We have followed the policy in the case of replacements of retiring the original capital in full and making the proper entries to depreciation reserve, the cost of removing being charged to operation.

One matter which has been discussed to a considerable extent by the officials of our company is that of paving over mains, which necessitates the raising or lowering of mains, which is ordered by a municipality, but for which the company has to stand the expense. Many utilities charge the entire cost of this work to operation even though the location of the mains may be changed; but we have followed the policy of retiring from capital the original cost of labor and material laying these mains, making the proper entries to depreciation reserve and charging into capital the cost of opening up the ditch, back-filling and paving and where the material was retired at a salvage value, this same value would be charged back to capital, when used in connection with construction.

Officers' salaries are classified by some companies in general expense, while others allocate these salaries to the various classified superintendence accounts. We have considered them as general expense, but distributed over our districts on the basis of gross revenue.

Any differences such as above would, of course, make comparison between various companies of little use.

Desirability of Uniform Accounting.—Uniform accounting classifications and procedures, in spite of the above mentioned difficulties, are undoubtedly desirable, at least as an ideal to strive towards for the following reasons:

Permits comparisons of financial position, operating results, etc., to be readily made between water companies.

Results in application of Federal Income Tax on a uniform basis between all companies.

Valuable to the investor in water companies securities, as financial statements prepared for circulars would be prepared on the same basis. In other words, the investor would be furnished with net earnings statements, etc., based substantially on the same accounting procedures, so that he could rely on the statement of earning capacity in relation to interest or dividend charges as being comparable between water companies all over the country.

Valuable to the consumer as he could be brought to realize that there would be less opportunity for discrimination in rates between water users of different communities due to the fact that the basis for ascertaining the return on the rate base would be similar.

Advantages to regulatory bodies. Most utility commissions have been given the regulation and control of utilities operations and many commissions require utility ocmpanies to keep their accounts and records in a manner prescribed by them. This control is exercised largely through accounting records, reports and procedures and these commissions are dependent to a great extent on the soundness of the accounting principles of companies under their jurisdiction.

Problems to Be Considered.—Adoption of a uniform classification of accounts by State Public Utility Commissions throughout the country. The National Association of Railway and Utilities Commissioners have provided a uniform classification of accounts which were revised November, 1922, and goes into the matter of utility accounting in a very comprehensive manner, and up to 1925 a total of 25 states have adopted completely, or nearly so, this uniform classification. Nine commissions have no jurisdiction over this accounting; one has adopted the Federal Power Commission's classification and twelve more have the classification under consideration.

Value of Uniform Classification of Accounts.—One of the principal advantages of uniform accounting is that proper comparisons could be made in financial statements and where a holding company has interests in many states, it is very evident that a uniform classification is desirable. The California Water Service Company reports to the Federal Water Service Corporation of New York under the National Association of Railway and Utilities Classification, while our accounts and records are carried under the California classification of Accounts as prescribed by the Commission. If the California Commission could be persuaded to adopt the National Association Classification, it would, of course, result in considerable saving to our Company.

Centralized Accounting.—This is a matter that should be considered very seriously by public utilities and as an example, I will briefly state the system which our company has adopted in this regard. We are operating twenty-two companies in California and by adoption of centralized accounting, we are enabled to properly classify accounts, to employ less expensive help in the outside districts, close our books earlier, and for the purpose of auditing or investigation by utility commissions, all original records remain in the General Office. This means that the General Office receives daily all Time Cards, Withdrawals of Stores Tags, Auto Mileage Reports, Bank Deposits, etc. As these reports are received by the General Office, they are checked and tabulated and at the end of the month we have only one or two days reports to enter.

In a large organization or even in organizations consisting of more than two or three separate properties, proper accounting control is absolutely essential for efficient and economical management.

Another feature of centralized accounting is the matter of employing specialized help. It has been proven that specialization in every case gives greater efficiency at a reduced cost.

Under the system of employing an accountant in each company or district, we have found that the interpretation of accounts differed to such an extent that departmental costs were entirely out of proportion. For instance, some accountants might consider rent, stationery and printing in the commercial department as a general expense, while others would consider it as a part of the commercial department. Centralized accounting eliminates these discrepancies and gives us a true analysis of these expenses over the various districts and the management is thereby enabled to place its finger on the companies or districts which are not operating efficiently.

The problem of educating the man in the field is extremely difficult, but with the adoption of centralized accounting and the use of accountants specialized in the study of classifications, we have eliminated our trouble in this respect.

Consumers Billing.—A great deal has been said as to the successful operation of the stub system of billing, but I believe that the stub system has been developed to such an extent that there is no longer any doubt in the minds of large utilities but that it is the most economical and successful method. Our company is preparing at the present time to adopt a stub plan, using a Government Post Card for mailing to the consumers. This alone reduces the postage to one-half, besides saving in the purchasing of envelopes. We have approximately 85,000 consumers and in postage, labor stuffing envelopes and the cost of envelopes themselves, we expect to save $20,000 per year.

Stores Accounting.—The method of handling the Stores Department varies considerably in utility companies, but proper stores accounting is essential to adequate control of materials and supplies.

A definite assignment of responsibilities for stores accounting activities is, of course, necessary if proper control is to be obtained. This is a very large subject and it appears to me that a uniform method of handling stores would be of very great benefit to public utilities.

We have adopted centralized stores accounting and we are thereby enabled, from the General Office, to analyze the quantities of materials and supplies on hand at any station, transfer any overstock from one station to another, keep accurate records of obsolete materials or junk, check up on slow moving material and see that proper credits are made to plant in the case of retirements.

We use accounting machines in this department and all pricing, posting of materials and withdrawals from stock, figuring average costs and balancing is done on two machines for twenty-two companies.

Machine Bookkeeping.—The introduction of bookkeeping machines into general accounting has, I believe, made very satisfactory progress, especially where the company has a large volume of calculations and the work can be concentrated into the hands of one or two machine operators, the result being that production will be higher and the unit cost much lower. This will also leave the more expensive help to carry out more important duties.

I have seen the bookkeeping machines used on public utility general ledger work, journalizing, cash books, daily cash statements, bank registers, capital stock records, stock sold on the installment plan and payroll work. The important result of machine operation is that the books of account are in balance at all times and the matter of taking off a trial balance is very simple.

Depreciation.—The matter of depreciation of plant should be considered very fully by the Association for the reason that there is no uniform method. At the present time, it is impossible to lay down any specific rates of depreciation which will have any absolute value for the reason that conditions under which equipment is used varies so much that no uniform rate could reasonably be determined for all utilities.

When we consider the number of methods used, i. e., annual apportionment of depreciation, straight line method, depreciation after percentage of diminishing value, annuity method and sinking fund basis, it is very obvious that a uniform system would be of great advantage. It must be remembered, however, that there are advantages and disadvantages in any system, and while the straight line method is more generally used on account of its simplicity, it may be conceded that the sinking fund method is the better. This system, however, is expensive, and would necessarily mean that uniform lives would have to be allotted to the various classes of fixed capital and very complete plant records set up, so that in retiring capital, the proper life of the plant involved could be determined.

It should also be borne in mind that in adjusting rates, most utility commissions go into the matter of depreciation very fully and many utilities have had to appropriate considerable money from their surplus to make up the depreciation reserve which the commission considered necessary.

In addition to the loss from wear and tear, equipment is subject to further depreciation from economic changes. Experience may show that on the average, certain equipment would be serviceable for twenty years, but becomes obsolete in one-half that time on account of new inventions and although the equipment itself might be in very fair condition, it would probably pay the utility to replace it with the improved type. A definite allowance, therefore, should be made for obsolescence and such an allowance will be recognized by the Internal Revenue Department.

Cost Accounting.—This is a subject that has not received a great deal of consideration from most utilities, but I believe that utilities are coming to realize the importance of keeping adequate cost records.

The principles and practices of cost accounting must be adopted to the utility business in order that companies may analyze their construction costs and properly record them in fixed capital accounts. The management should also be advised as to what construction work is costing and this can only be done with adequate cost records.

This Association could co-operate with the National Association of Cost Accountants towards the adoption of some uniform system.

Budgeting.—It is very important that utilities provide adequate budget control not only for capital expenditures, but also for maintenance and operating expense so that the proper co-ordination be maintained between the amount of capital going into industry and the use of such capital in construction programs.

In the utility business a budget is essential as a statement of future operating and extension plans, financial program, summary of appropriations and a standard for the measurement of performance.

Purposes of the Budget.—To define executive policies as to future operations.

To promote co-operation in the execution of policies and plans.

To prescribe the limits into which expenditures are to be confined.

To determine what funds will be required and when, so that they may be provided in a reasonable and orderly manner and at a minimum cost.

To set up standards by which accomplishment may be judged.

The companies using budgets most successfully are those in which the line and staff have had their part in the preparation of the estimates necessary for the construction of the budget and since budgets set forth a complete plan, every division of the company should be represented in the preparation of the estimates.

The preparation of a budget should be under the direction of an officer of the company who is intimately familiar with the affairs of the company and of utility operations in general. He should understand accounting, financial and operating problems thoroughly and be familiar with the functions of all the departments of the business.

The accounting staff is the logical one to handle the accumulation of budget data, since they are the most familiar with the cost of previous operations of the company. As a budget must be based on the operations of the past, it is desirable that the accumulation of these data be placed in the hands of those who are most familiar with it.

The preparation of a budget should be in considerable detail and given a specific number so that when the approval is given for expenditure of money, a reference can be made to the budget number and the final cost of the work for expenditure involved should tie in closely with the figure on the budget. For example, we might have an item in the budget for the building of a reservoir which would bear a certain budget number and when the authorization is given for the actual expenditure of the money, the budget reference should be shown on the authorization, so that when the work is finally completed, a check can be made against the estimated cost.

This is another phase of the business which would benefit greatly by uniform accounting.

Rates Paid by Large Cities for Water for Municipal Purposes

The following information on the above subject is taken from a report compiled by the Municipal Reference Division of the Seattle Public Library for the Water Department of Seattle, Wash. Questionnaires were sent to the 33 cities of over 200,000 population in this country.

Rates Paid by Cities for Water for Municipal Purposes. — The following cities report some payment from the city:

Akron. "Small amount annually."

Buffalo. Four cents per 1,000 gal. (1924 information). No hydrant rental.

Denver. "Some departments supplied free, others at reduced rates."

Indianapolis (private company). Rate not given. Water for hydrants supplied on inch-foot basis with nominal annual rental.

Milwaukee. Regular rates. Hydrant rental $10 per year per hydrant.

Minneapolis. Free water for general city service. Parks and libraries pay 4 ct. per 100 gal.

Oakland (private company). Regular rates for metered service. Public use charge based on number of feet of streets piped and number of hydrants: $10 to $50 per year per 1,000 ft. piped according to size of main, and $8 to $10 per hydrant per year if owned by the company, or $3 to $5 if owned by city. Basic charge for public use in 1917 was $105,500.

Omaha. No charge for city buildings or for flushing streets. All water used for sanitary sewer system in excess of 50,000 gal. per flush tank per month charged for at regular rates. Hydrants $60 per year.

Philadelphia. Schools and charitable institutions, 6 ct. per 1,000 cu. ft.

Pittsburgh. Public buildings at hotel rates. Charitable institutions and schools have free allowance, then 7 ct. per 1,000 gal. (1924 information).

Portland. $75,000 per year.

Providence. Most municipal supplies pay regular rates. No hydrant charge (1924 information).

Rochester. $150,000 per year.

St. Louis. Schools and libraries, 6 ct. per 100 cu. ft. Charitable institutions 4½ ct. per 100 cubic feet. No hydrant charge.

St. Paul. Regular rates. Hydrant charge $14 per year per hydrant.

San Francisco (private company). Regular rates. Hydrants, $5 per month per hydrant.

Seattle. For flushing streets, $14,400; for hydrants, $9 per year per hydrant.

The remaining cities considered in the compilation report no charge for water supplied for municipal purposes.

Jersey City has a book charge of $75,000 a year. In Detroit hydrants are furnished and maintained by the Fire Department. No recent information has been received for Atlanta, Boston, Jersey City or New Orleans. These cities in 1924 reported free water.

No information is available for Baltimore.

What They Think of an Engineer for President

Editorial Comment on Nomination of Hoover

THE DAILY NEWS, Chicago:

For the first time in the history of the United States a great national party has nominated for chief magistrate of the republic a distinguished engineer and an internationally famous administrator. This is not wholly accidental, being in truth significant of the trend of modern thought and of the increasing public demand for constructive ability and scientific leadership in politics, legislation and diplomacy. . . . The nature of the problems now confronting the United States has created a demand among men of affairs for the objective mind, which approaches public questions in a spirit of impartiality and which insists upon knowledge and certainty as preliminaries to important action. . . . The republican national convention has nominated for president a strong and able man, a man essentially open-minded and constructive, a man of vision and wide experience. Whether his passion for efficiency has removed him in any degree from the plane on which best can be understood the trials and aspirations of the common man is for the American people to judge in the coming political campaign. Apparently he is the true and lawful heir of the Coolidge policies.

THE OREGONIAN, Portland, Ore.:

Hoover is well equipped to deal with domestic problems. He knows from his work as food administrator the basic facts about agriculture and his titanic struggle in the early months of 1919 to save the American farmer from ruin by saving Europe from famine is abundant proof of his sympathy with the farmer. That sympathy, joined with his knowledge of economic law, is assurance that he will find a plan to dispose of surplus crops without resort to economic quackery. The Government has entered upon a number of construction projects so vast as to require at its head a man with the ability of a chief engineer. Hoover is such a man.

THE VINDICATOR, Youngstown, O.:

In nominating Herbert Hoover for president the Republicans have chosen their best man. . . . Hoover is the country's great administrator. We have come to look to him for everything from directing Mississippi relief to reducing the number of radio stations, and from finding foreign markets for our products to standardizing the sizes of blankets and lumber and paving bricks. It is his business in life to eliminate waste and promote efficiency. If he is elected president we shall see the movement to make industry more productive carried to its logical conclusion. Washington will be filled with conferences of all kinds, in which men and women from every nook and corner of the country will meet to try and find better ways of doing things. A great administrator, a great organizer, Hoover would be a great engineering president. He would work to improve things, not in the interests of capital or of labor, but for the sake of doing the job better, of doing it the best way men know how.

PLAIN DEALER, Cleveland, O.:

It is a circumstance which invites new confidence in democratic government when a great party turns to a man like Herbert C. Hoover and makes him its nominee for President. Whether he is elected or defeated in November, Hoover brings character and promise to the Republican ticket. He is a new kind of candidate in a day surfeited with old forms and old habits in politics. Hoover typifies efficiency. He thinks in terms of getting things done. To him government is an engineering problem, and like a master chess player he maneuvers his forces to the desired end.

THE TRIBUNE, Chicago:

The nomination of Herbert Hoover as Republican candidate for the presidency was given with a majority so impressive and with an enthusiasm so genuine and unforced that there is left no doubt it expressed the preponderant will of his party or that Mr. Hoover can go into action with the confidence in the authority of his leadership and the loyalty of his support. . . . Perhaps Mr. Hoover's main appeal to the judgment of the country rests upon his accomplishment in the gigantic task of war relief in Europe, a task of unprecedented scope and complicated difficulties, both administrative and diplomatic. In Belgium and western Europe, and later in center and eastern Europe, Mr. Hoover demonstrated executive genius of the first order. Returning to the United States, he has served with great ability in the administration of three Presidents, in various capacities, but most notably as secretary of commerce in the cabinets of Harding and Coolidge. His conduct of the department of commerce has been marked by initiative and creative energy. . . . For demonstrated executive ability, no candidate has ever sought the office of chief executive with greater justification.

THE STAR, Kansas City, Mo.:

In Herbert Hoover the Republican party has nominated a man with a remarkable training for the presidency. He has the background of working on the farm as a boy. He has had large business experience. He is an expert on foreign affairs. He has a passion for the big problems of an economic age. He has had ten years in Washington in contact with public questions, with congress, and with public men. He has administered a great government department. . . . There is the human side to Hoover that the country will learn as it becomes better acquainted with him.

POST-GAZETTE, Pittsburgh, Pa.:

Herbert Hoover has been nominated for the presidency of the United States at the Kansas City convention. . . . Mr. Hoover's marked ability has been demonstrated again and again in his long years of faithful service. His personal integrity and character are beyond question. In the light of his record as Secretary of Commerce in the administrations of President Harding and President Coolidge all citizens can rest confidently in the assurance that he will make a capable President.

DAILY JOURNAL, Elizabeth, N. J.:

The logical as well as the expected has happened in the nomination of Herbert Clark Hoover for President by the Republican party. Seldom, since the time of Lincoln, has the party made so good a choice. It has seized and firmly held one of the greater opportunities of its existence. It would be difficult in this time to find a man so consummately adapted to the occasion, and to the needs of the country. Herbert Hoover has long represented the most constructive of statesmanship in aggressive action and performance. The country, and the world at large, has turned to him to undertake great tasks. He has easily taken them upon his broad shoulders and performed them. He has a mind that plans work that is enduring. . . . The record of Herbert Hoover shows him not to be just a prominent American among prominent Americans; but a builder of American and world welfare, who stands as high as the highest. He has exhibited a positive genius for construction; and his character stands for moral construction, as his achievement has registered so greatly in solving the more material problems of the nation. He has a genius for serving human welfare; and that is the type of man who appeals to Americans in these reconstruction days. He is a man of boundless resources, as his record shows.

Layout Planning for Municipal Airports

Outline of Provisions Necessary for Effective Service

By CARL H. WOLFLEY

St. Joseph, Mo., Consulting Aeronautic Engineer; Chairman, Committee on Airports and Airways, National Aeronautic Association

WHEREVER permitted by state law, city authorities should own and operate the municipal airport. The Aero Board or Aviation Committee will be charged with the duty of securing the necessary engineering services for planning and laying out the airport. This layout should provide hard surface for landing and taking off, hangars, repair shop and service station, standard markers for the field and lighting, parking space for automobiles, taxis, and buses, and the usual utilities including water, sewers, gas, electricity and telephones. If not provided for elsewhere, the administration building should include passenger and express depot, a rest room, sleeping quarters for the personnel and pilots, restaurant, first aid facilities and provisions for weather bureau reports.

Size and Shape.—The size and shape of the field will be somewhat dependent on local conditions. Every city planning a first class airport will, however, have at least the space necessary for the layout such as shown in the accompanying sketch of the model airport. The area provided for future expansion will depend upon the city.

It may seem difficult to estimate the amount of air traffic to be provided for. At the present time several airports in the United States are handling about 1,200 planes a month. A few years ago a year's production of airplanes was small. This year the leading factories have more orders than they can fill and several thousand new planes will be put in service. From the point of view of the aviation industry, it is a conservative estimate to say that we can expect 5,000,000 planes in operation in this country at the end of the next ten or fifteen years. Even today, a first class airport should be equipped for planes landing or taking off every five or ten minutes. This does not mean, of course, that all construction must be completed in advance, but the plans should be so complete that additional buildings and runways may be readily added each year to serve the increased traffic.

Location of Buildings.—It is recommended that in the beginning all buildings be located along one side of the field in order to concentrate administration and service facilities. It may be necessary later to add one or more rows of additional buildings adjoining these, but locating the buildings on one side of the field leaves the entire field free for planes landing and taking off under favorable conditions without obstructions and also leaves the field free for expansion in three directions. The necessary buildings should be of permanent construction, fireproof and weatherproof. A conventional size for a hangar today is 100 ft. wide and 120 to 140 ft. long with 18-ft. clearance throughout the inside. A truss roof should be used. Reinforced concrete, cement block, stucco or other masonry material may be used for walls. Masonry walls are recommended in every location to assist in keeping the building warm in winter and cool in summer. A goodly amount of window area should be provided and skylights used where center lighting is desired. Concrete strips or ramps 100 ft. wide should extend along the front and sides of the hangars and connect with the runways. Modern service stations for oil and gasoline should be constructed. It is recommended that pipe lines lead in various directions to points on the field where the service of air, water and gasoline may be rendered from storage pits covered by trap doors. The general scheme for the buildings should give thought to an arrangement that will be attractive and dignified. A reasonable amount of space for flower beds and shrubs around the building is highly desirable. We are planning now for what will soon become one of our most important industries. Airports today are more in the public eye than any other municipal building, park or recreation center. They demand the same careful attention and details that our railway stations, city halls, and modern office buildings receive.

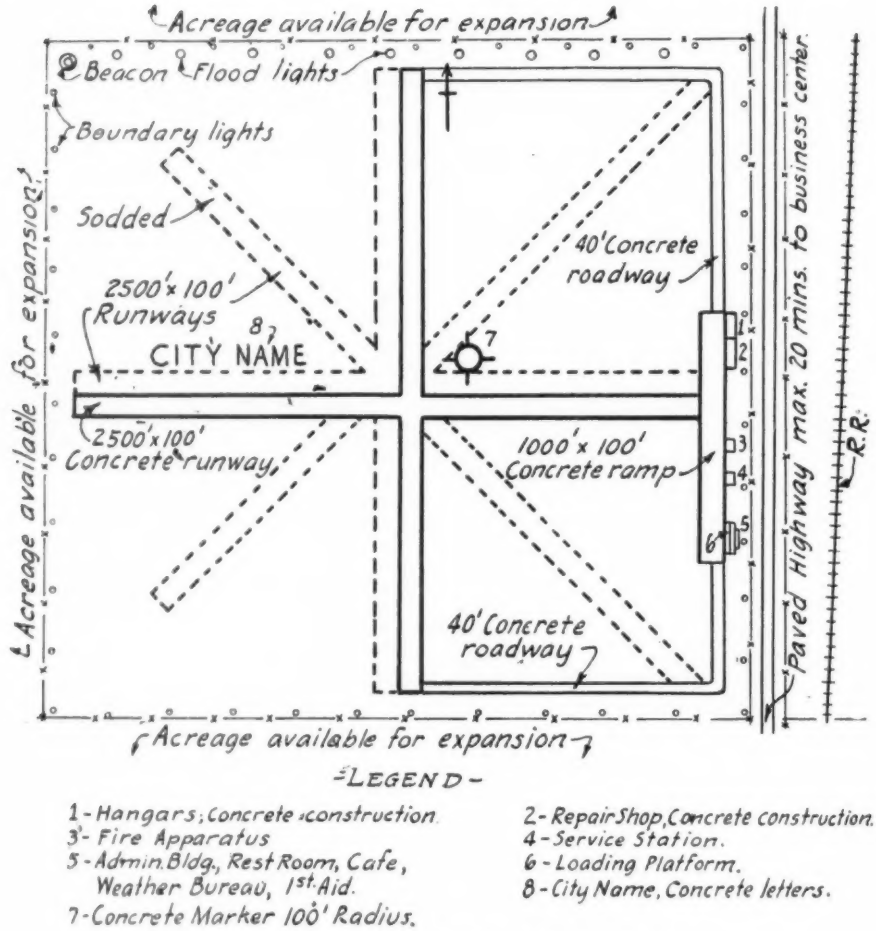
Runways.—The sketch of the model airport shows eight landing strips meeting at the center. Each pair has a minimum length of 2,500 ft. clear. Another layout might not show all of these intersecting, but the sketch shows the greatest economy in space where a landing strip is provided in every principal direction.

Very few fields are as fortunate as St. Joseph, Mo., having a naturally solid bearing surface and an all-over type of field signifying landing or tak-

PROPOSED RATING AND COMPARISON OF COMMERIAL AIR PORTS

ITEMS	CLASS				
	FIRST	SECOND	THIRD	FOURTH	FIFTH
1. No. of runways 200' wide or paved strips 100' wide - safe in all weather.	8	8	4	3	2
A. Total distance in clear each direction	3000	2500	2000	1500	1200
B. Capacity, planes per day.	500	500	250	150	100
2. Acreage and available for expansion	600	400	300	200	100
3. No. of Hangars 60' x 100' x 15' or larger	4	2	1	1	–
4- Repair Shop.	1	1	1	–	–
5- Service Station	1	1	1	1	–
6- Fire Apparatus	1	1	1	1	–
7- Administration Building	1	1	–	–	–
A Rest Room	1	1	–	–	–
B Passenger and Express Depot	1	1	1	–	–
C Sleeping Quarters	1	1	–	–	–
D Restaurant	1	1	–	–	–
E First Aid Facilities	1	1	1	–	–
F Register of Arrivals and Departures	1	1	1	–	–
G Weather Records and Reports	1	1	1	–	–
H Utilities - Sewers, Water, Gas, Electricity and Telephones	1	1	1	1	–
8- Improved Highways to Civic Center	1	1	1	1	1
A - Regular Transportation Service Day and Night	1	1	Day	Day	–
9- Railways Facilities - Siding Space	1	1	–	–	–
10- Automobile Parking Space - Cars	500	300	200	–	–
11- Lighting and Signals					
A- Boundary Lights	1	1	1	–	–
B- Flood Lights	1	1	1	–	–
C- Hangar Lights	1	1	–	–	–
D- Code Lights	1	1	–	–	–
E- Beacon Lights	1	1	–	–	–
F- Ceiling Projector	1	1	–	–	–
G- All Night Service	1	1	–	–	–
12- All Year Drainage System for Field	1	1	1	1	–
13- Standard Markers					
A- Center Marker	1	1	1	1	1
B- Wind Indicator	1	1	1	1	1
C- Magnetic Meridian	1	1	1	–	–
D- Station Name and Code No.	1	1	1	1	–
14- Adequate Seaplane Accommodations					
A- Water Area Similar to Land Area	1	1	1	1	1
B- Runways	2	1	–	–	–
C- Hangars	2	1	–	–	–
15- Accommodations for Dirigibles					
A- Mooring Mast	1	1	1	–	–
B- Hangar	1	1	–	–	–

Proposed Rating and Comparison of Commercial Air Ports



Drawing of a Suggested Layout for a Modern Airport

ing off in any direction. At St. Joseph, this consists of several feet of river sand thoroughly compacted over a long period of years. On most fields the surface needs drainage and usually underground piping to remove surface water as soon as possible after a storm. In the northern states an otherwise good field will be rough in winter when slight irregularities are frozen. In the long run, the cheapest construction to give hard, smooth surface in all weather and all seasons of the year is concrete for the runway surface. The natural surface adjoining should be seeded down with a grass that is suitable for the climate. In many cases bluegrass and clover will be best. It will take 12 or 14 months of good care to secure a permanent sod. Even with an all-over type of field at least two concrete runways affording 4-point landing and take-off are recommended. Concrete landing strips as shown will adjoin the natural runway.

Heavy Planes.—While many commercial planes today weigh from 5 to 7 tons, heavier weights must be expected. It is advisable that these runways be constructed to carry loads of at least 25 to 30 thousand pounds. Each concrete runway should be at least 100 ft. wide, although on fields of lesser importance it may be possible to get along for a few years with half this width. Concrete connections should be extended from the runways to the ramps and hangars. On some fields, runways have been constructed of cinders or surface treated stone or slag. As a business proposition, this construction cannot be recommended. Cinders are always dirty and, blown up by the wind from the propeller, may seriously damage the propeller or engine. Other light types of surfacing are expensive to maintain and when constructed for the loads to be carried will cost almost as much as the concrete and lack concrete's durability. It must be remembered that in addition to the planes themselves landing, and taxiing over the field, heavy trucks will use the runways at times in giving service to the planes.

Where the airport can be located on a body of water of sufficient size, additional provisions should be made for amphibians or seaplanes. Since the planes will land and take off from the water, buildings for their accommodations will be located along the shore and one or more concrete runways will extend from the ramp to a point several feet below the surface of low water.

The present features to be considered in the layout of the modern airport are listed in the table shown on this page. This table conforms in most respects to the preliminary requirements of the United States Department of Commerce. The table should be carefully studied in planning the airport. Service, convenience, accessibility, and appearance must be provided today for the many municipal airports that soon must serve not less than 500 planes a day.

Water Flow Formulas

The following paragraphs from the June New Reclamation Era give the formulas used by the engineers of the U. S. Bureau of Reclamation for estimating the flow of water in pipe lines of various materials:

Let Q=discharge in cubic feet per second.

D=diameter of pipe in feet.

d=diameter of pipe in inches.

H=friction slope in feet per 1,000 ft.

Wood Stave Pipe

$$Q=1.21\ D^{2.65}\ H^{0.555}$$

This is Scobey's formula modified by a safety factor of 5 per cent, as recommended on page 66, Bulletin 376, United States Department of Agriculture.

Cast Iron Pipe

$$Q=1.31\ D^{2.7}\ H^{0.558}$$

This is the formula given in Bulletin 376 referred to above. The Bureau of Reclamation has had very little occasion to calculate the flow of water in cast-iron pipe.

Precast Concrete Pipe

For pipe 12 in. to 21 in. in diameter:

$$Q=0.00179d^{2.625}\ H^{0.5}$$

For pipe larger than 21-in. diameter:

$$Q=0.00192d^{2.625}\ H^{0.5}$$

These are Scobey's formulae modified by a factor of safety of 5 per cent as suggested on page 54 of Bulletin No. 852 of the United States Department of Agriculture, the values of Scobey's coefficient C_s used being 0.345 for 12-in. to 21-in. diameter pipe and 0.370 for pipe larger than 21-in. diameter. Owing to the inability of working inside of the smaller group of pipe the finished joints between pipe units are rougher than for the larger group.

Monolithic Concrete Pipe

For monolithic concrete pipe cast in place, the Chezy formula is used, with Kutter's $n=0.014$.

Riveted Steel Pipe

The bureau now has no single formula for universal use in calculating the flow of water in riveted steel pipe. For the smaller sizes of pipe, where plate thicknesses and rivet heads are not large, the Hazen-Williams formula is used. This formula is $V=Cr^{0.63}\ S^{0.54}\ 0.001^{-0.04}$. The value of C is usually taken as 100, r is the hydraulic radius and S is the slope. For the larger sizes of pipe the Chezy formula is used. The value of Kutter's n used varies from 0.014 for the smoothest condition of inside surface up as judgment dictates.

Drain Tile

For drain tile, the practice has been to use the Chezy formula with Kutter's $n=0.015$.

Experiences of York Water Co. in Reforestation of Water Sheds

Abstract of Paper Presented at 48th Convention Am. W. W. Assn.

By EDGAR P. KABLE
General Manager, York Water Co., York, Penn.

THE water works authorities, being so busy protecting their supplies, rarely consider that by reforesting their sheds they increase the timber reserves and are creating an asset which is becoming more valuable every year. The "harvest is on" almost from the start if properly planted. If evergreens are used and planted close some can be removed within a few years and readily sold as Christmas trees, leaving the remainder to mature. With the exception of a few varieties, after once a tract is completely planted it will perpetually regenerate or maintain itself by the falling of the seeds to the ground beneath and the sprouting of the same. This natural regeneration can be assisted by the sowing of additional seed at the thinner stands.

Selection of Species for Planting.—The species of tree to be selected for planting on a water shed depends on the locality, soil, elevation and effect of the leaves or other flowers which fall from the trees.

Some of the deciduous trees deposit leaves which within a short time mould in process of decay and impart an objectionable odor, color and taste to the water which is eliminated with difficulty in the process of filtration. These leaves are also objectionable if they find their way onto the screens of an intake channel of a pumping station and obstruct the flow of the water.

This has been overcome in certain localities by planting evergreen trees along the waters' edge and planting the deciduous trees at some distance from the water. In this way the evergreen trees act as a barrier or trap and hold the leaves, whereas the needles of the evergreens usually imbed themselves on the surface of the ground and rarely reach the water.

The evergreen tree where practicable to plant, appears to have some advantage over the deciduous tree for water shed protection in that the needles deposited beneath the tree create a soil condition which permits the precipitation to more readily penetrate the top surface of the soil, whereas the litter formed on the ground by the deciduous tree becomes wet and slimy with the initial rainfall and the remainder of the rain has a greater tendency to flow over the surface to lower points.

When a tract selected for reforesting is found to contain scrub trees of a different species from that intended to be planted, it becomes necessary to cut down these scrub trees and cut their sprouts annually for the first three or four years as this growth shades out the new trees. This is particularly true of cases where hardwoods are replaced with conifers.

The Size of Trees for Planting.—A very important matter to be considered in the outset of a reforesting project is the selection of the size of tree. A seedling tree is one that has grown in the nursery or set in a bed for two or three years from seed during which time it has not been transplanted. Transplants vary depending upon the kind and duration of the transplanting period. The expression 1-2 transplant means that when the seedling was 1 year old, it was transplanted and then remained in the nursery for two years more giving it a total age of 3 years. The expression 1-2-1 transplants means that when the seedling was one year old it was transplanted and after two years it was transplanted again and then remained in the nursery for another year, giving it a total age of four years. The expression 2-2 transplant means that the seedling was transplanted at the age of 2 years, and then remained in the nursery for two years more, when it had a total age of 4 years. The expression 1-2-2 transplant means that the seedling was transplanted at the age of 1 year and after two years was transplanted, also again after two years was transplanted giving it a total age of 5 years.

Too Small Trees Undesirable.—The experience which I have had with planting has shown that too small a tree is equally as undesirable as too large a tree for successful reforesting. The loss the first year in using seedlings has been as much as 30 per cent. It is true that this 30 per cent can be replaced the second year yet, as a rule the labor of planting is the expensive part of reforesting. If a large tree, say a five year transplant, is used the trunk is rather rigid and when the wind sways the tree it creates an opening in the ground down to the roots and permits the air to enter. A three year transplant seems to be the desirable tree to plant. The trunk is flexible enough to permit the wind to sway it back and forth without creating the objectionable air pocket. The system of roots in this sized tree are numerous and compact. In the plantings at York, Penn., when over 100,000 trees were planted in a single season the loss in the first year was as low as 2 per cent.

When the trees are received from the nursery, great care should be taken in unpacking to see that they are not exposed to the air as the roots dry readily and the tree dies. Immediately after unpacking, the roots of the trees should be immersed in a compound of earth and water about the constituency of cream and then should be heeled in while in bunches in a furrow so that the roots and trunks are completely covered, letting only the top remain exposed. They can remain in these trenches while the planting is progressing. The time to plant will depend entirely upon the location but should be done as early in the growing season as practicable. Spring seems to offer some advantages over fall planting.

Small nurseries located on a desirable lot adjoining a water shed are not only desirable but profitable. Seeds or seedlings can be planted in rows and with very little care will produce plants suitable for forestry planting within three or four years at a nominal cost with the added advantage that the plants are available for planting early in the season within the area to be reforested. This avoids the necessity of extensive packing and often long and expensive hauls with the accompanying losses in transit.

Fire Prevention Measures.—The greatest enemy of the forest is fire. Fire originates in most cases from the carelessness of man and every precaution should be taken to protect the trees from this hazard. Fire lanes through the tracts should be provided where there is a sizable planting. These lanes should lead from the main highways and should be of sufficient width so that when the trees mature they will permit men on horseback to pass back and forth through the tract. It is impracticable to make the lanes wide enough to prevent the leaping of the flames across them. The number will depend on the species of tree planted and size and topography of the tract. These lanes should be kept mowed close to the ground and free from dry grass or other inflammable material. An

equipment consisting of fire rakes, axes, approved chemicals or other extinguishers should be kept at convenient stations on the tract. If the forest is of sufficient size and so located that all trees cannot be observed from a common point, an observer's tower should be provided and observations made continuously if the tract is used by the general public so that the first curl of smoke can be detected and an alarm given immediately. Usually this matter is ably handled through the various State Bureaus and every owner of a forest should be in close touch at all times and confer with the active heads of these bureaus. The spring and fall seasons during which most of the fires occur, the greatest precautions should be taken and during these times it is important that extra patrol be carried on.

Another hazard is disease, but fortunately in this agency, the most fatal disease attacks only one species,—as for example the chestnut blight attacks only the chestnut tree and the white pine blister rust the white pine tree. By planting several varieties on the same tract the likelihood of total failure through disease is practically eliminated.

Through the prompt action of the Federal authorities and those of several of the states the blister rust appears to be under control at least for the present.

The white pine weevil also attacks the leader of the white pine trees and stunts its growth but does not as a rule prove fatal to the tree.

The writer has had experience with apparent success with the planting of red pine, white pine, European larch, silver fir, douglas fir, hemlock and Norway spruce.

Plantings of York Water Co.—The impounding basin tract of The York Water Co. located along the Susquehanna Trail four miles south of the city of York, Penn., and 45 miles north of Baltimore, Md., contains about 700,000 evergreen trees of the above mentioned varieties in a very flourishing condition. The land is rolling, being typical of Pennsylvania, and formerly constituted farm land in a high state of cultivation. This is the tract which the eminent authority, Dr. C. A. Schenck of Darmstadt, Germany, formerly director of the Biltmore Forest School, declared to be the best example of evergreen reforesting in the world. The first plantings were under the personal direction of Professor J. W. Toomey, Dean of Yale Forest School. Dr. Joseph S. Illick, State Forester of the Commonwealth of Pennsylvania and his staff and Major Robert Y. Stuart, now United States Forester rendered valuable assistance. This tract is visited frequently by foresters of the various states and others interested in forestry and the management of The York Water Co., York, Penn. will be pleased to have you all visit the tract at your convenience.

Summarizing the subject we find trees where there is water and water where there are trees and no trees where there is no water and no water where there are no trees. Water is what we want and by nature the trees follow and we believe we can hurry along more water by planting more trees, so let us help the coming generations by planting the forests and let them stand as our heritage to future generations and an abundance of aqua pura will follow.

It may not be amiss to quote Humboldt's saying: "How foolish is man in destroying the mountain forests, as thereby he deprives himself of wood and water at the same time."

City Transportation Bureau Centralizes Control of All Municipal Cars

The city of Baltimore, Md., has a bureau of transportation which controls the operation and maintenance of approximately 350 motor vehicles of the city government. These include the equipment of all departments except the police and fire departments, public parks and city hospital. An interesting account of how the bureau functions was given by Charles W. Pohlman, Superintendent, in a recent issue of the Municipal Journal, the official publication of the city.

On Sept. 1, 1925, the day on which the bureau started active functioning, a dispatch system was inaugurated, working much on the same basis as taxicab service and assuring all department heads and their assistants of quick transportation, cars being furnished with or without chaffeur. The system has since proved of great service to those officials who, having no cars assigned to their departments, were forced of necessity to use taxicab or hired cars. There are 20 cars used for dispatching while all other cars are on permanent assignment to inspectors, foremen, etc., of various departments.

Prior to the passage of the Ordinance organizing the bureau, there were 22 departments which purchased, operated and maintained their own equipment, while other departments either had no means of motor transportation or used taxicab or hired cars. The bureau is now serving 35 departments with transportation and the occasion for hired cars is rare.

There being no appropriation allotted by the board of estimates for operating expenses, all operating funds other than office salaries are obtained from the revenue collected from the various other departments through vouchers rendered monthly. Charges are made through rates set up annually, estimated so that the total revenue for the year will not exceed the amount necessary for the operation and maintenance of the old vehicles and the purchase of new equipment. The rates so applied, vary in accordance with the different classes and types of cars and trucks.

In its efforts to centralize the storage of city cars, the bureau has gradually brought about the elimination of storage in private garages, for which rental was paid, and thus effected quite a savings for the city. There are still a few cars stored out, this being necessary because they are assigned to health department doctors and special investigators who are liable to summons at any time of the night.

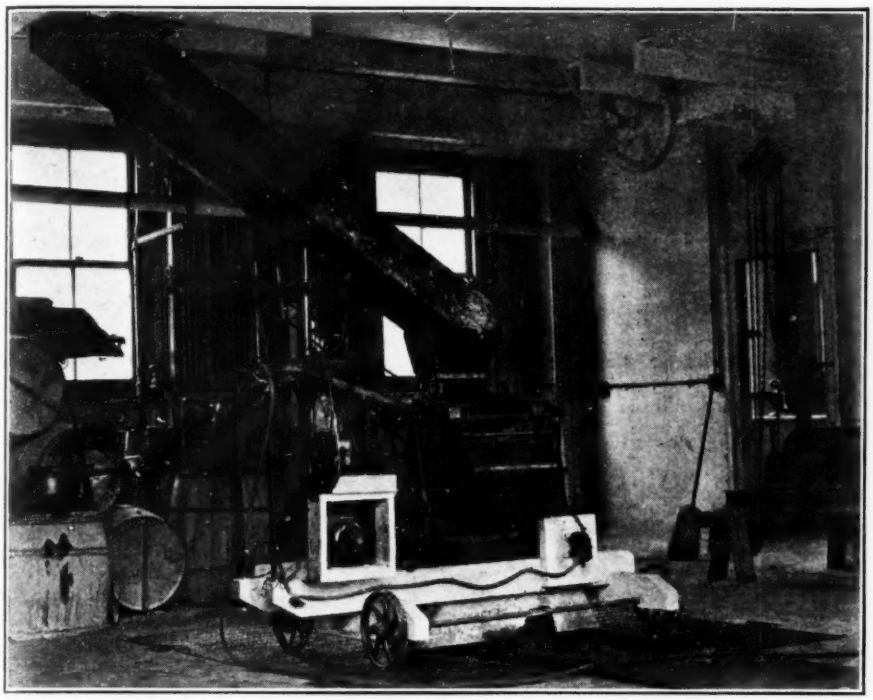
Up to the time the new municipal garage in the basement of the municipal office building, was put into use, the cars under the jurisdiction of the bureau were stored at five different city yards. Most of these cars have already been transferred to the new garage. There is space available for from 150 to 175 cars. As the trucks are no longer under the jurisdiction of the bureau, they were transferred back to their respective bureaus on Oct. 15, 1927, only cars will be kept in the municipal garage.

Water Accounts at Columbus, O.—According to the recently issued report of the Division of Water of Columbus, O., C. B. Hoover, Superintendent, at the close of the year 1927, the total numbered services was 58,206, this being composed of 55,088 active services and 3,118 inactive, or services in no way used during the year for delivery of water. Excepting 458 services, all active services are metered; and included in the 458 unmetered services, are 169 taps for flushing sewers and 178 private fire protection services, representing the automatic service mainly. The average net amount received, per service, for semi-annual metered water was $10.48; the monthly services average $235.38. Per service, it cost $2.38 to pump the water; purifying, $3.78; and total cost of operation, plus interest on bonds and sinking fund charges, was $22.04. From commercial consumers, numbering 2,659, 53.9 per cent of the revenue received for metered water supplied, was received; and from 51,032 semi-annual consumers, 46.1 per cent was obtained.

Use of Oil Burners Reduces Ash Collection.—A significant item appears in the report of the operations of the Engineer Department of the District of Columbia for the fiscal year ended June 30, 1927. In the report of the city refuse department Mr. Morris Hacker, Supervisor City Refuse states:

"The quantity of ashes collected was within 1 per cent of that collected in the previous year, indicating a mild winter, and also the growing use of oil burners, which seems to balance the increased number of residences."

Recent Developments in Municipal Construction and Operating Equipment



One of the Dry Chemical Feed Devices Used in Purifying the New York City Water Supply

Feeds Dry Chemicals with Accuracy

A photograph on this page shows the installation of a Power Feed AMF Automatic Weighing Machine at the Valhalla, N. Y., station of the New York Board of Water Supply, Gas and Electricity, where it is used to automatically weigh and discharge dry chemicals into the water undergoing treatment at that plant. This device, model 883B, is said to have an accuracy of 90 per cent balanced weights and 10 per cent within ½ of 1 per cent of balance.

This device is said to be fully automatic in action and may be quickly and easily adjusted to weigh any definite quantities of chemicals at predetermined intervals. Continuous action takes place within the scales while the hopper is kept supplied with chemicals.

These machines are manufactured by the Automatic Weighing Machine Division of the American Machine and Foundry Company, 5502-5524 Second Ave., Brooklyn, N. Y.

Climax Offers Direct Connected Pump

The Climax Engineering Company, of Clinton, Iowa, offer a drive for any type of water pump. The engine is mounted on cast iron rails which in turn is applied to a cast iron sub-base direct connected to the pump which is also mounted on the same base by flexible coupling cushioned in rubber.

The engine used is Climax Model KU, 4 cylinder, 5 in. x 6½ in. and is conservatively rated with ample reserve power to drive a 6 in. water pump with a capacity of 1,200 gal. per minute, against a 75 ft. head. A unit of this type is said to be ideal for semi-permanent or permanent installation, and being mounted on its own base it is easily portable.

New Fire Station Door by Truscon

A new type quick-acting door was installed recently by the fire department of Hempstead, L. I., in its fire station, and has attracted considerable interest from architects and fire chiefs who have seen the door in operation.

The door operates in two units of two doors each, and an electric motor providing the power. The entire opening is cleared in five seconds, and operation is noiseless and free from jar when the doors swing to the full open position, according to the manufacturers.

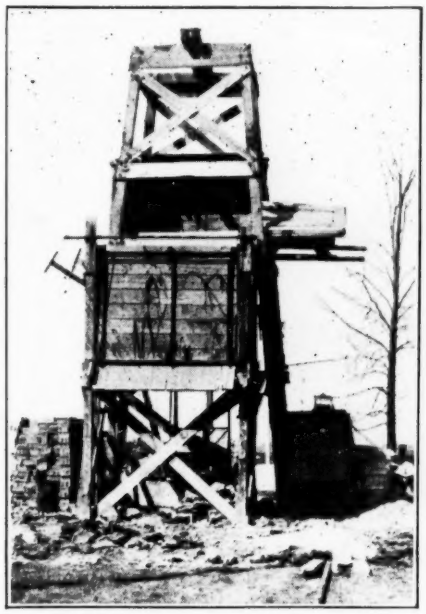
The operation is in response to a switch thrown by the man in charge of the station upon receipt of an alarm. The doors are open full before the driving motor on the fire engine can be started.

The Hempstead doors are painted cream with a black trim, and present a very pleasing appearance. They were manufactured and installed by the Truscon Steel Co. of Youngstown, Ohio.

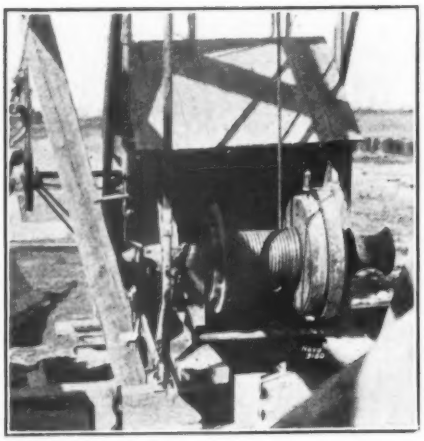
Use of Hoists at Tunnel Shafts

On sewer and aqueduct work in tunnel, disposition must be made of spoil. On level country it is usual to sink shafts and install some sort of hoisting apparatus in the shafts to raise the spoil to the surface for loading into trucks or other equipment in which the spoil is hauled to the dump. Typical examples of such work are the sewer jobs being done by Louwers and Somerville, Michigan Theatre Bldg., Detroit, Mich., in that city. These contractors are using three Novo single drum, electric powered hoists on their sewer tunnelling jobs in that city, at different shafts. The illustrations show how these hoists are arranged to handle both spoil and sewer lining materials.

A head frame was erected over the excavation, and at one side, halfway up, a bin was built. This bin held the excavated material; trucks being loaded by gravity from this hopper. Above the hopper was a track and small industrial car, serving the purpose of a platform for the spoil bucket to drop upon, which action emptied the spoil bucket. The car was rolled aside while the spoil bucket was being hoisted to the top of



Headworks Layout at Sewer Shaft to Hoist Spoil and Lower Materials to the Tunnel. The Spoil Is Loaded by Gravity Into Motor Trucks



Novo Hoist Operating at Sewer Tunnel Shaft

the head frame; the hoist operator controlling both the spoil bucket and car. The spoil bucket was 45 in. long. 24 in. wide, and 18 in. deep.

At one side of the shaft, a 10-S electric powered mortar mixer was placed, which dumped into a bucket lifted and lowered by the Novo NH hoist, powered with a 7½ H.P. electric motor. Brick was piled on the other side of the excavation, which was also lowered by the hoist down the shaft, which had a depth of about 40 ft. Approximately 200 brick constituted a load, which, as in the case of the spoil, weighed, including the bucket, 1,500 lb.

Such tunnel operations, while expensive, obviate open cuts and are particularly adaptable to certain ground conditions that are encountered in various parts of the country, and are often preferable where otherwise the cuts would be of excessive depth.

New Spark Control for Climax Engines

The Climax Engineering Co. of Clinton, Ia., has perfected and now offers for sale on its heavy duty industrial engines a new Automatic Spark Control.

This new spark control operates from the suction in the intake manifold. As the variation in pressure in the intake manifold is proportional to the load imposed upon the engine, the ignition is always timed correctly, no matter how the power varies on intermittent loads, and by timing the spark automatically, this new device does what operators could not possibly do by hand, according to the manufacturers.

There is little loss of power and the fuel consumption decreases to a point where a saving of 10 per cent on fuel is attained on intermittent loads, such as are encountered in earth moving machinery, locomotives and similar classes of equipment, it is claimed, and that it will reduce spark knocks and reduce wear on bearings.

The Automatic Spark Control can be quickly installed in the field on any model Climax engine. The small additional cost of installation is offset in a few months by the saving it affords in fuel consumption. It can be applied by Climax Service Stations.

This is one of the many new exclusive features that the Climax Engineering Co. is incorporating on its engines to meet the present day need for modern and up-to-date power equipment.

New Type Perfex Radiator for Diesels

A new type of radiator for Diesel and heavy duty engines has just been announced by the Perfex Corporation. The new feature is the mounting of an unusually large air circulating fan directly on the radiator frame. This is completely protected by a screen as shown and shrouded to insure uniform air circulation over the entire radiator. The fan is carried on anti-friction bearings and provided with a large enough belt pulley to insure positive fan operation over long periods without attention, it is said. On account of the large size of both radiator and fan it is usually very difficult to mount the fan on a Diesel engine and at the same time locate it where the radiator may be efficiently cooled.

These radiators also incorporate the latest developments in removable core sections. Each unit is securely held in place by four nuts. This permits removal and repair of any individual section without dismantling the radiator and also continued operation of the power plant for reasonably long periods while a section is out. An alternative is to carry a reserve section which can be put in the place of a damaged section in a few minutes.

The cores of these heavy duty radiators are made from copper to prevent corrosion. The tubes are oval in shape, have double lock seams that are said to make them burst-proof when frozen. Copper, heat radiating fins, strengthened by reammed front and rear edges, furnish a most efficient design of cooling unit. These are baked onto the tubes in ovens that have automatic temperature control in order to insure uniformity of product. To supply the industrial field, a full line of these radiators are now available for prompt delivery in sizes from 50 to 350 hp.

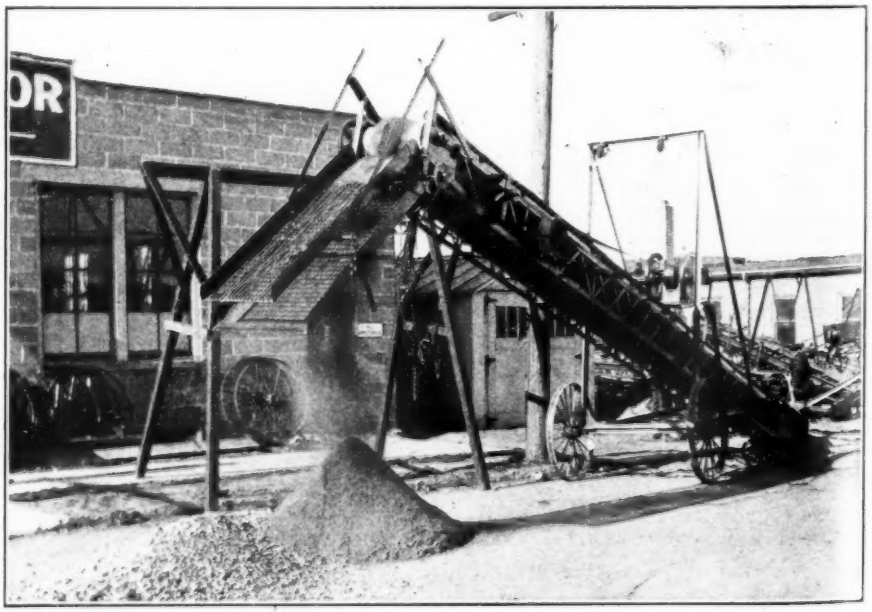
New Combination Conveyor and Screen

The photograph on this page shows the new Northern portable conveyor in operation with shaker screen attached.

This equipment has recently been patented by the Northern Conveyor & Mfg. Co., of Janesville, Wis. The combination of their style of shaker screen with many of their portable conveyors results in a complete loading and screening plant of the portable type on two wheels that may be moved from place to place on a moment's notice by hitching on behind a truck or wagon.

It carries its own power plant, requires no assembly when moved to a new location or no mechanical labor to make ready for moving. It is a complete, portable plant—without question the simplest on the market, according to the manufacturers. It does for a small gravel pit or a contractor everything that large, heavy and cumbersome conveyors and screening equipment with hoppers will do, yet at the same time there is no erection involved as the equipment comes to a customer completely set up in every respect, it is said.

Its cost is very small and the shaker screen or the conveyor may be used separately and quickly detached from one another for their respective uses.



New Combination of Portable Conveyor and Shaker Screen Announced by Northern Conveyor and Mfg. Co.

Speeder Announces Half-Yard Machine

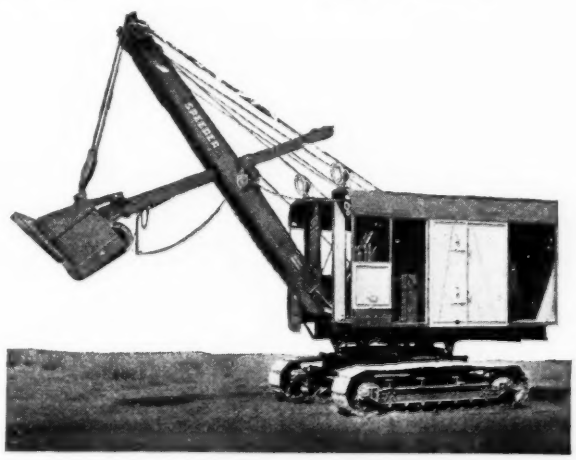
A new model, the B-2, has recently been introduced by the Speeder Machinery Corporation, Cedar Rapids, Iowa, manufacturers of Speeder fully convertible, full revolving gasoline and electric excavators.

The new model is of one-half yard capacity and incorporates many improvements over the Model B-1, which no longer is in production.

The sliding gear used in the Model B-1 in making the change from traction to swing has been made obsolete by the introduction of a reversible jawed clutch assembly. The new jawed clutch assembly retains all the desirable features of the sliding gear formerly used and has the added advantages of positive mesh of the gears at all times, and of making all vertical shafts removable and readily demountable, insuring unequalled ease in operation as well as long life.

Electric lights and starter are standard equipment on the new model. There are two flood lights on the top of the cab for night work or travel by night, a dome light in the top of the cab which illuminates the upper mechanism, and a spot light that is used for a trouble light. The starter button is situated on the floor boards. The operator can shut off his motor while waiting for trucks and start immediately by stepping on the starter button. The operator operates all the controls, gas and spark levers, light switch and starter button while seated in his seat near the front of the cab.

A Hercules Model OX engine is used in place of the Model O used in the Model B-1, thus giving added power. Other improvements on the new model Speeder are double tread sprockets that are much heavier in weight and a large turntable that is likewise greatly increased in weight.



This New Model Speeder Machine Has Interesting Features

Pump Manufacturer Announces New Line

The Frederick Iron & Steel Co., Frederick, Md., who have been manufacturing centrifugal pumps for a time, have now added a line of hand and power operated diaphragm pumps. These new pumps have been especially designed for handling water containing mud, sand, gravel, sewage, grit, and other material, and should prove quite useful on such jobs for which this type of pump is used, such as in trenches, cellars, sewers, manholes, and so on.

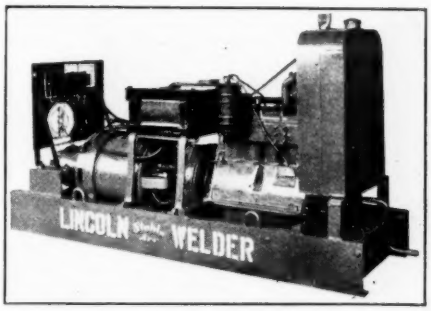
The pumps are said to be of extra heavy construction and simple in design, with the diaphragm of highest quality rubber. The pump has rubber faced suction and discharge valves, properly weighted, with the suction regularly threaded for iron pipe. Bottom and side suction types are supplied in 2½ in., 3 in., and 4 in. sizes, with respective capacities of 1800, or 3500, and of 6000 gal. per hour. Portable outfits arranged for either engine or electric drive will be furnished to order. Detailed information and prices will be supplied by the manufacturer upon request.

New Gas Engine Driven Welder

To meet the growing demand in construction work of all kinds, The Lincoln Electric Co. of Cleveland O., announce a new model of the "Stable-Arc" welder, known as their S-1960 Model.

The ever increasing importance of arc welding in structural work, pipe line construction, and similar work, has indicated the need of a self contained, light weight, readily portable arc welder with its own motive power.

The new unit has a rating of 200 amperes according to N. E. M. A. standards, with a current range for welding duty of from 50 to 300 amperes, and operates at a speed of 1,500 r.p.m. Motive power is provided by a four cylinder Continental Red Seal engine, type H-9.



New Gasoline Engine Driven Welder Announced by Lincoln Electric Co.

The welding generator and engine are mounted on a structural base welded into a solid piece of steel. This welded steel base is said to provide a maximum stiffness and rigidity with a minimum weight; the whole unit weighing only 1,580 lb. and being only 76 in. long by 25 in. wide.

The generator is also constructed of steel instead of cast iron, usually used. Thus, not only reducing weight but also reducing the possibility of breakage in the field.

The complete magnetic circuit of the generator is of laminated steel structure, thus increasing the stabiiity of the arc which is highly desirable in work for which this unit was brought out, because many times welding must be done in a vertical plane and frequently overhead.

A steel switchboard is also provided in place of the usual slate or composition board, thus still further reducing the possibility of damage in the field.

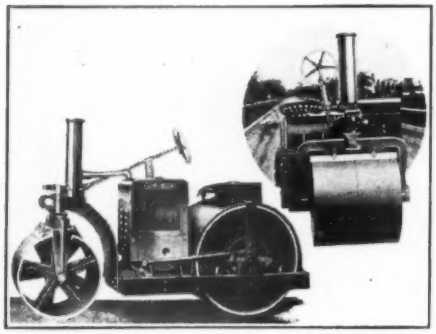
It is stated by the company that this unit is not designed to replace their present heavy duty engine driven equipment but to meet the need for a light but sturdy unit.

New Roller for Small Contractor

The Pierce Governor Company, of Anderson, Ind., has announced a new light roller that should prove of value on light small jobs were a 1½ to 2 ton roller is sufficient for the purpose. This new roller is especially adaptable, it is said, to such operations as rolling crushed stone, filling station drives, concrete floors under construction, subdivision work, and asphalt between street car tracks, as well as for rolling park lawns, golf courses, tennis courts, and for similar work. It is small enough for use in close places where a large roller could not be handled.

The operator sits above the rear roller in the middle of the machine, with a clear view in all directions and controls the roller as easily as he would an automobile. Frame clearances are such as to permit rolling up to a curb or within four inches of a wall.

The rear roller is hollow and may be filled with water, sand or iron borings to make the desired weight. This drum



New Pierce Roller Designed for Small Jobs

holds approximately 1,000 lb. of water.

The entire frame is of steel. The motor runs at any speed from idling to 1,800 R.P.M. under governor control. Speed is instantly adjustable from driver's seat.

The motor is a Continental Red Seal, and is a solid unit with clutch and transmission, and this motor is completely housed, while clutch and transmission are enclosed. The transmission has one speed forward and one reverse. Shafts are mounted on New Departure ball bearings. The best of materials are used in all parts and a sixty-day guarantee is made to cover defects that might be discovered. Alemite lubrication is provided throughout.

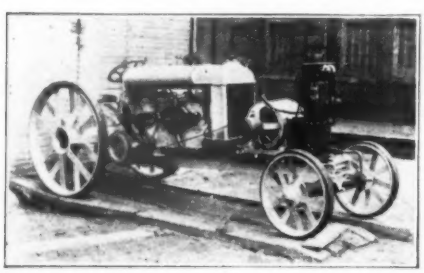
The manufacturers say that production of one roller a day will soon be reached.

New Tractor-Welder Combination

A new mounting of the standard Lincoln electric stable arc welders has been announced by the sales department of the Pontiac Tractor Co., Pontiac, Mich. The welder unit with stabilizer and panel are mounted on a frame, which attaches to either the McCormick-Deering 10/20 or Fordson tractors.

This mounting of the Pontiac Lincoln Arc Welder gives a 4-wheel rubber tired self-propelled unit, capable of hauling heavy loads behind itself. This unit is also mounted on crawlers for soft ground work.

Power is taken from the tractor, to drive the welder, through the power take-off pulley, which has a clutch, allowing it to be thrown out or into gear at will. The ahead drive of the belt brings the belt tightener into the correct relation with the belt.



New Combination of Welder and Tractor for Pipe Line Work

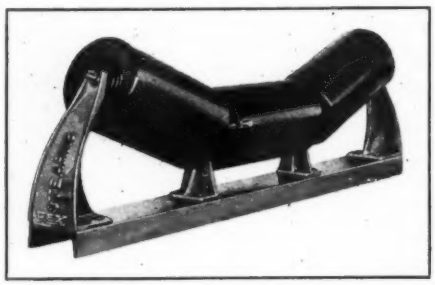
The manufacturer states that a number of these units have been put out as special equipment over a period of four years and have proven successful on pipe line construction and structural steel fabricating, showing considerable saving over former methods of welding.

New Carrier for Belt Conveyors

A new Rex-Stearns belt conveyor carrier has been announced recently by the Stearns Conveyor Co. of Cleveland, O., for mounting their pressed steel and chilled rim cast iron idler units.

Several noteworthy features are included in the design. The supporting brackets are made of certified malleable iron, and by the redistribution of the metal, a much stronger bracket has been worked out than is possible in grey iron with no considerable increase in the total amount of metal used.

The spacing between idlers is reduced to $\frac{7}{8}$ in. on this new Rex-Stearns carrier. With this close spacing, there is



New Belt Conveyor Carrier Recently Brought Out by Stearns Conveyor Co.

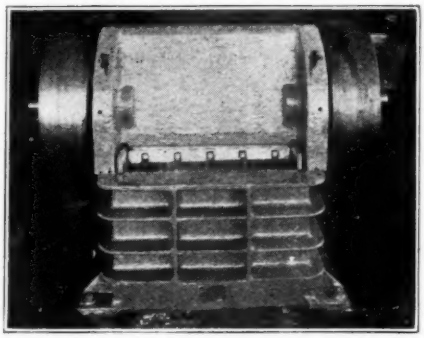
very little chance of the belt "creasing" and being worn accordingly. With this new type of bracket, it has been possible to secure this close spacing and at the same time keep the idlers safely mounted and quickly and completely interchangeable. Any idler can be removed from the carrier without disturbing any of the others.

The carrier is offered in the following sizes: 18 in., 20 in., 24 in., 30 in. and 36 in., with either Rex-Stearns pressed steel or chilled rim cast iron idlers, both having one-piece pulley shell construction, Timken bearings, long time lubrication, and the Stearns positive grease seal which serves the double purpose of keeping dust out of the idler and grease within it.

The new idler is interchangeable with previous Stearns units. The Stearns Conveyor Co. is owned by the Chain Belt Co. in Milwaukee, Wis., who manufacture chain conveying equipment.

A New Roller Bearing Wheeling Jaw Crusher

The Wheeling Mold & Foundry Co. of Wheeling, W. Va., who have been manufacturing jaw crushers for over 15 years, announce that they are now marketing a roller bearing jaw crusher, after months of experimental work and



New Roller Bearing Jaw Crusher

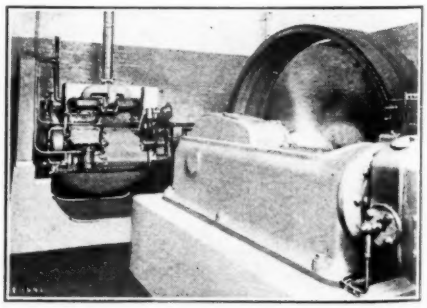
shop tests. Both pitman and main frame bearings are equipped with roller bearings, needing no adjustment.

Factory tests on hard granite and slag through a 9 x 36 crusher, weighing 10,270 lb., with hopper fully loaded, are stated to indicate less than 10 HP. actual ammeter readings. It also is stated that it was possible to turn the crusher freely by hand, and several large granite boulders were thrown in and actually crushed by turning the flywheel by hand. The roller bearing types are claimed to be practically free from vibration. The frame is a solid one piece cast steel structure as in the past. All jaws are manganese steel. Shaft is nickel alloy steel. Bearing construction is fool proof and dust proof. All parts are interchangeable. Regular equipment includes cast steel guard, wrenches and oil gun. The company manufacture the new crusher in four standard stock sizes, together with its regular line of bronze bearing crushers.

Air Compressor Driven by High-Speed Diesel Engine

An interesting application of Diesel power is shown by the accompanying illustration. It consists of a two-stage 16 in. x 10 in. x 14 in. air compressor of the horizontal type driven by a four-cylinder Buda-M.A.N. Diesel engine of 6 in. bore and 8 in. stroke operating at 950 r. p. m. A Twin Disc clutch is enclosed in a housing bolted directly to the flywheel enclosure, and the engine is connected to the compressor by means of a short belt and idler pulley.

The compressor delivers 400 cu. ft. of air per minute against a pressure of



Two-Stage 16 in. x 10 in. x 14 in. Air Compressor Driven by Buda-M. A. N. Four-Cylinder 92-Hp. Diesel Engine Operating at 950 R. P. M.

130 lb. per sq. in., and the air is used to operate Harris air-lift pumps in a deep well, raising the water from a depth of approximately 167 ft. and delivering it to a storage tank.

The engine is the full Diesel type, with a normal operating speed of 1,000 r.p.m. and rated at 93 hp. at that speed. The actual brake-horse-power load varies from 80 to 87 hp.

Fuel with a gravity of 28 to 30 deg. Baume is used, and is supplied from the storage tanks through a Niagara meter to a tank mounted on the engine-room wall. From the latter the fuel is fed to the injection pump on the engine by gravity, and a Zenith duplex filter is installed in the line to remove any foreign matter that may be in the fuel. Fuel is injected by the mechanical or solid-injection system, which is under control of the built-in governor. The time of injection can be advanced or retarded manually, and the quantity of fuel regulated, so that the speed of the engine can be controlled manually as well as by the governor. The fuel is conducted from the injection pump through steel tubes to dividers mounted on the cylinder jacket, from which the fuel is delivered to spray nozzles on opposite sides of the combustion chamber of each cylinder. The two nozzles are diametrically opposite, and the fuel is sprayed into each chamber parallel to the top of the piston. The nozzles are so arranged that the "sprays" pass to each side of the radial center line of the combustion chamber, so that the fuel spray cones do not meet, thereby causing turbulence of the oil particles. Consequently, combustion is complete and efficient, as evidenced by the fact that fuel consumption ranges from 0.40 to 0.45 lb. per brake horsepower, and that smoke is absent from the exhaust under widely varying loads and speeds.

Lubrication is accomplished by means of a positive gear-driven pump of large capacity, a pressure of 45 lb. per square inch being maintained to all bearings, piston pins, and to the valve gear on each cylinder head. All moving parts are enclosed to promote cleanliness and lubricating oil economy, and a filter cleans all oil before it passes back into the engine. A lubricating oil reservoir fitted with gauge glass, settling tank and screen is mounted on the flywheel housing. The dry sump system is used to insure uniform lubrication under all conditions.

A small air-cooled, two-cylinder, opposed-type, gasoline engine, shown at the right in the accompanying illustration, is mounted on the flywheel housing and is used for starting duty. This engine is connected by a conventional type Bendix gear through a manually operated clutch and a short roller-chain drive. The Diesel starts with the same kind of fuel used for regular operation, and no compressor or preheating devices are required.

This engine was installed several months ago for the purpose of observation and test, and is operated by the regular power-house attendants. The only attention required is limited to a brief visit of the engineer several times a day, it is said, and the replenishing of fuel and lubricating oil at stated intervals.

The Buda-M. A. N. Diesel engine is built under license and patents of the M. A. N. Company of Augsburg, Germany, with whom Dr. Rudolph C. Diesel was associated until his death. It was in the M. A. N. shops that Dr. Diesel built his first engine about 35 years ago. The Buda-M. A. N. is built by the Buda Company, Harvey, Ill.

A Plaster Mixer with a Hoist

Installation of a hoist on their plaster mixer, "The Mechanical Hoeman," has been announced by Marsh-Capron Company, Chicago, Ill.

The hoist is mounted on the counter shaft of the mixer, and can be operated while mixing or independently. It is provided with an automatic brake which holds the load when the clutch is disengaged. The large winch head projects in the front of the machine, making it easily adapted for the operation of elevators or other hoisting work. The hoist is also provided with a safety ratchet and with automatic lubrication by compression grease cups. The standard engine equipment has been found to give ample power for a large amount of hoisting work.

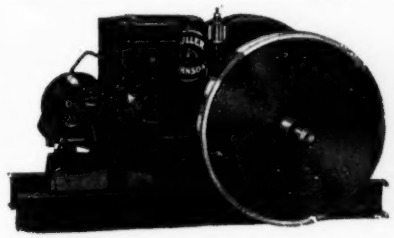
Another improvement recently announced on this plaster mixer is a new stuffing box on the hoe shaft. A semi-metallic packing is used in an outside stuffing box mounted in a cast head in the drum head casting. The packing can be changed at any time without dismantling any other part of the machine and the packing glands can be tightened while the shaft is revolving. An open space between the stuffing box gland and the bearing prevents plaster from working into the bearing housing, thus assuring long bearing life. The machine is provided in two styles of mounting—a four-wheel rubber-tired trailer, with telescoping steel hauling hitch where a high degree of portability is desirable, or on truck with four steel wheels.

The "Mechanical Hoeman" is provided with a mixing hoe formed of steel bars especially shaped to give rapid, thorough mixing and complete scraping of the barrel at every revolution. Discharge is effected by rotating the drum, the discharge spout being part of the drum itself and so shaped as to confine the batch to a narrow stream, permitting discharge directly into wheelbarrows.

The completely enclosed 2 cylinder hopper-cooled LeRoi or Novo engine is continued as standard equipment, with electric motor drive optional. This equipment turns the hoe shaft at a speed of 24 R. P. M.

Fuller & Johnson Announce Improved Engines

Interesting improvements have been recently made in three of the engines manufactured by the Fuller & Johnson Mfg. Co., Madison, Wisconsin. These three improved industrial engines are known as Model "NC," in 1½, 2 and 2½ h.p. One of the recent improvements to be found on this model is the solid disc flywheels and the gib key shroub, making for better appearance and greater safety and which make for smoother running. These models are designed to be mounted on steel channel skids of 3, 4 or 5-in. channels, which may be mounted with the angles facing in or out and which are available in any length. Thus installation problems



This Shows the General Appearance of the New Line of Industrial Motors Recently Produced by the Fuller and Johnson Mfg. Co.

are easily met. The cylindrical fuel tank, located between the skids, is attached directy to the cylinder casting, to which it is attached by a cradle of 2-in. adjustable steel strap. The tank is strengthened with a rolled bead at the point of contact with the strap.

The gasoline filler pipe is amply large enough to permit filling without the use of a funnel, and is carried out at an angle so as to make it easy to insert a measuring rod. This pipe is fitted with a threaded cover to avoid spilling the fuel in case of a portable installation. The tank is air vented to permit rapid filling.

The throttle is easily accessible to the operator, while the water drain has been placed on the operating side of the engine. The vaporizer opening is from the bottom of the elbow, making a presentable appearance.

These engines are equipped with a simple governor that adjusts the frequency of power impulses in accordance with the load, thus making for efficient operation. The cooling system is comprised of good sized water hoppers and water passages entirely surrounding the cylinders to their full length.

These motors are well built for long life, low maintenance, and economical operation, according to the manufacturers.

Chicago Board of Education Has Director of Safety.—A full-time director of safety has been appointed by the Chicago Board of Education. His duties are to promote safety education, traffic reform, increased playground facilities, and to arouse public interest in the work.

New Trade Publications

The following industrial literature of interest to the City Engineer, the City Manager, the Superintendent of Streets, the Water Works Superintendent, and to the engineer or other man otherwise interested in municipal construction, design, or operation problems, has been received. Copies may be secured by writing direct to the manufacturer named.

Compressed Air Tools.—Ingersoll-Rand Company, 11 Broadway, New York City, manufacturers of pneumatic tools, compressors, and related equipment, have issued a new condensed catalog, Form 1604-A, that illustrates and briefly describes such Ingersoll-Rand products as portable compressors, rock drills, paving breakers, hoists, clay diggers, pneumatic tools, hose, steels, and other equipment that is widely used. Copies of this catalog can be secured upon request.

Pumps.—Beach-Russ Company, 50 Church St., New York City, have issued a new bulletin, No. 37, describing their rotary pumps, designed for a number of different kinds of service. Complete condensed data on these pumps will be found in this bulletin.

Power Shovels.—The Koehring Company, Milwaukee, Wis., has sent out a folder telling how the Koehring independent crowd means full dipper loads on any job. This is one of a series of folders prepared by this concern telling about their power shovels and other equipment.

Gasoline Engines.—Climax Engineering Company, Clinton, Ia., has sent out a bulletin, under date of April 21, telling what the new spark control on Climax engines means to the user.

Electrical Equipment.—General Electric Company, Schenectady, N. Y., has issued a number of new bulletins describing various electric control apparatus, such as controllers, D. C. motors, centrifugal air compressors, arc suppressor plates, automatic throw-over panels, enclosed starting rheostats, magnetic controllers, etc. Ask for bulletins GEA-894, 948, 950, 934, 308-A, 233-B, 752 and 835-A.

Curing Agent.—Barber Asphalt Company, Philadelphia, Pa., has issued a booklet telling about Curcrete, their new asphaltic emulsion that is sprayed onto the surface of a new concrete pavement to provide a good condition for curing the concrete.

Celite.—Celite Products Company, 1320 S. Hope St., Los Angeles, Cal., has issued a specification sheet on the use of Celite as an admixture in concrete. Special directions are given for use under a water-cement ratio specification.

Floodlighting.—General Electric Company, Schenectady, N. Y., has issued a new and comprehensive bulletin, GEA-161B, on equipment for floodlighting, and for general searchlight and airport lighting. This bulletin shows a variety of equipment available for these purposes.

Super Cement.—Lawrence Portland Cement Company, New York City, have published an interesting catalog describing their Dragon Super Cement, a cement that is particularly manufactured for obtaining concrete that is waterproof, and resistant to the action of salts and oil. This cement is standard portland, to which have been added a gypsum material Catacoll, and Tannin in a certain proportion, taking the place of some of the usual gypsum retarder. The Catacoll itself is said to promote the hydration of the silicates and aluminates in the cement. The booklet gives information about this cement that is worth reading.

Cement Gun Construction.—The Gunite Concrete and Construction Company, 1301 Woodswether Road, Kansas City, Mo., have just issued an attractive bulletin entitled "Cement Gun Shots—Bulletin No. 7," which contains 32 pages 8½x11, and 95 illustrations, all pertaining to various classes of Cement Gun construction performed by this company in their thirteen years exclusive experience in this type of construction, and this bulletin will be forwarded to anyone upon request without obligation on their part and should particularly interest all Consulting Engineers and Architects.

Portland Cement.—International Cement Corporation, 342 Madison Ave., New York City, has recently published an interesting booklet entitled "Trade Ethics and Marketing Policies," containing an outline of the business policies of the concern. The first page of this 38 page booklet states 31 points of trade ethics observed by the company, the second part is an explanation of the factors and conditions which control the price policy of the company, and the last part of the booklet presents a statement on the reasons for the sales policy observed. This concern and its subsidiaries manufacture and market Lone Star cement.

Form Clamps.—Beton Forms Engineering Corp., 75 Tenth St., Long Island City, New York, has issued a bulletin describing the Beton Column Form Clamp. This is a metal clamp using four wedges for setting, and is said to be very strong and to cost less than other clamps.

Industrial Notes

The Naylor Spiral Pipe Company announces that, with the completion of their new plant and the increase of their facilities some 200 per cent the name of the company has been changed to the Naylor Pipe Company. The new product of this organization, Spiralwell Toncan Iron Pipe, no longer being comparable to light weight, sheet metal pipe, but putting it rather in the category of standard weight pipe, has necessitated the increased facilities, as well as the change in company name. There will be no change in management, all officers and executives carrying on in their present positions.

The T. L. Smith Company of Milwaukee, builders of Smith Mixers and Pavers, announce the appointment of Woodward-Wight Company of New Orleans as their distributors for Louisiana and southern Mississippi. The new distributors have long been identified with the supply and equipment business in this territory and are particularly well equipped to handle this new account. A full stock of mixers and parts are being carried to insure immediate sales and repair service.

The Chain Belt Company has elected Robert W. Baird, Milwaukee banker, a director to fill the vacancy caused by the death of H. O. Seymour. Mr. Baird is Vice President of the First Wisconsin National Bank, President of the First Wisconsin Co., and Vice President of the First Wisconsin Trust Co. Directors re-elected to the board of the Chain Belt Co. are Donald Fraser, William C. Frye, J. C. Merwin, C. R. Messinger, Clifford F. Messinger and Edgar L. Wood. The Chain Belt Company was organized in 1891 and operates three plants in Milwaukee, West Milwaukee and Cleveland. The Cleveland plant operates under the name of the Stearns Conveyor Co., having been acquired 18 months ago. During the last year the Chain Belt Co. purchased the plaster and mortar mixer business of the Atlas Engineering Co., and also acquired the pump and saw rig business of the C. I. Longenecker Co., both local concerns. The Contractors Equipment Co., at Miami, Fla., is also owned by the Chain Belt Co. The products manufactured include concrete mixers and pavers, conveying equipment, chain for power transmission and other material handling machinery. Milwaukee concerns closely affiliated with the Chain Belt Co. are the Interstate Drop Forge Co., Federal Malleable Co., and the Sivyer Steel Casting Company.

The Celite Company of Los Angeles announces that effective April 30, 1928, they have purchased the plant and property of the National Magnesia Manufacturing Company at Redwood City, about 25 miles south of San Francisco. The business of the latter company will be continued under the name of the National Magnesia Company. Both The Celite Company and the National Magnesia Manufacturing Company started in business in 1912 and since that time have built up businesses of national and international scope. The manufacturing plant of The Celite Company is located at White Hills, (near Lompoc) California. This is the largest plant in the world engaged in the manufacturing of diatomaceous earth products (including heat insulating materials, filter-aids, admixtures for concrete and many grades of mineral fillers.) The business at Redwood City includes the manufacture of magnesia, asbestos and diatomaceous earth insulating materials. This business will be continued and the scope of its service enlarged under the new name, National Magnesia Company.

The Mathieson Alkali Works, Inc., 250 Park Ave., New York City, manufacturers of heavy chemicals, announces the appointment of E. E. Routh as Manager of Sales, following the resignation of John W. Boyer, who had occupied that position for the past six years. Mr. Routh has been a member of the Mathieson organization for 30 years, with the exception of four years in college, having started in as office boy at the Saltville Plant at the age of 11. For the past 8 years he has held the important post of Southern Sales Manager, with headquarters at Charlotte, N. C. Effective at once, he will now be transferred to the executive offices of the company in New York City. The company also announces the appointment of Fred O. Tilson, who has been representing the company in the Southwest, as Southern District Sales Manager, with offices at Charlotte.

The Ames Pump Company, 90 West Street, New York, a division of the Staten Island Ship Building Company, has appointed Yeomans Brothers Company, 1423 Dayton Street, Chicago, to handle their line of vacuum heating pumps in Chicago and vicinity. Yeomans Brothers Company are manufacturers of sewage ejectors and pumping machinery.

H. P. Sigwalt, who for the past five years has been advertising manager of the Milwaukee Corrugating, has entered the advertising agency field with the Cramer-Krasselt Co., Milwaukee, where he will take charge of the Industrial Advertising Division. As former Secretary and at present 3d Vice-President of the National Industrial Advertisers Assn., Vice-President of the Milwaukee Advertising Club, and formerly President of the Milwaukee Association of Industrial Advertisers, Mr. Sigwalt is widely known in the advertising profession. His broad and varied experience in the advertising department of Geuder, Paeschke & Frey Co., Milwaukee, and as Advertising Manager of Federal Motor Truck Co., Detroit, Mich.; American Optical Co., Southbridge, Mass.; T. L. Smith Co., (concrete mixers), Milwaukee, and Milwaukee Corrugating Co., Milwaukee (Milcor Sheet Metal Products), has helped him develop an advertising-merchandising perspective which should prove valuable in the advertising agency field. Mr. D. C. Smith has been appointed to succeed Mr. Siwalt as Advertising Manager of Milwaukee Corrugating Company.

Mr. H. L. McCauley has been appointed District Sales Manager of the Inland Steel Company's Milwaukee Office succeeding Mr. C. M. Easterly, who recently resigned. Mr. McCauley has been assistant district sales manager of this office since 1924. From 1920 to 1924 he was in the Order Department of the Inland Steel Company at Chicago. Prior to that time he was associated with the American Sheet & Tin Plate Company at Gary, Ind., Pittsburgh, Pa., and Saltsburg, Pa. Mr. M. E. Gregg will succeed Mr. McCauley as assistant district sales manager in Milwaukee. Mr. Gregg has been assistant district sales manager of Inland's St. Paul offices since 1925. His previous business associations were with the Bethlehem Steel Company, Lackawanna Steel Company, Republic Iron & Steel Company and the Basset-Presley Company.

The Webster Manufacturing Co., manufacturers of elevating, conveying and power transmitting machinery whose office in Cincinnati is in charge of Mr. L. A. Scheck, are moving their headquarters from 1914 Union Central Bldg., to 503 Chamber of Commerce Building. Mr. Scheck is an experienced engineer in the elevating and conveying line, and has been in the employ of the Webster Manufacturing Co. for a number of years. Before taking charge of the Cincinnati office he was in charge of the Boston office of the Webster Mfg. Co.

J. H. Williams & Co., Buffalo, and the Husky Wrench Company, Milwaukee, announce the completion of a reciprocal sales arrangement which enables them to supply the trade with a unique line of Combination Wrench Sets. Each set is composed of Williams' "Superrenches" and "Husky" Socket Wrenches in popular sizes and furnishes the most complete and efficient wrench service obtainable, it is claimed. These sets are said to offer the first and only combination of high grade Chrome Alloy Steel Open-End and Socket Wrenches in standard assortments. Every "Superrench" and "Husky" Socket is guaranteed against breakage. This arrangement enables each company to merchandise in Combination Sets the other's quality Open-End or Socket Wrenches. It is made for sales purposes only and is limited to the items which constitute the sets.

The American Hoist & Derrick Co., of St. Paul, has just appointed J. T. Seaver, Inc., Fairmount Cedar Building, Cleveland, Ohio, its representative for the Cleveland district.

The T. L. Smith Company of Milwaukee, builders of Smith Mixers and Pavers, announce the appointment of the Service Supply Corporation of Philadelphia as their distributors for eastern Pennsylvania, southern New Jersey and northern Delaware. This organization has been prominently known in this field for some time and resident salesmen throughout their territory give them particularly close contact with the construction industry. A complete stock of mixers and repairs for both mixers and pavers place this organization in a position to render immediate sales and repair service.

Mr. F. A. Ernst has been appointed Assistant District Sales Manager of the Inland Steel Company's St. Louis office effective immediately. Mr. Ernst succeeds W. F. Brumm, who was advanced to the District Sales Managership of this Inland Office last August. Mr. Ernst's business career started in 1914 with the Trumbull Steel Company. He has been associated with the sales departments of several steel companies since that time—most recently he was in the Chicago office of the American Rolling Mill Company.

The National Aluminate Corporation, a Delaware Corporation, with general offices at 6216 West 66th Place, Chicago, announces that it has purchased the stock, names, patents, trade marks and good will of the Chicago Chemical Company and the Aluminate Sales Corporation, both of Chicago. The new officers are Arthur Meeker, Chairman of the Board; H. A. Kern, President; P. W. Evans, Vice President, and H. J. Young, Secretary-Treasurer. Dr. G. J. Fink will remain at the head of the research department.